Registered at the G.P.O. for Transmission to Canada by Magazine Post.

Vol. 43. Ser. A. Part 9. pp. 257–296. SEPTEMBER, 1955.

THE REVIEW OF APPLIED ENTOMOLOGY

SERIES A: AGRICULTURAL.

ISSUED BY THE COMMONWEALTH INSTITUTE OF ENTOMOLOGY.

LONDON:
COMMONWEALTH INSTITUTE OF ENTOMOLOGY,
56, QUEEN'S GATE, S.W.7.

Price 4s. net.

Commonwealth Agricultural Bureaux

EXECUTIVE COUNCIL.

J. E. C. Coventry, B.A., M.Sc., *Chairman*, Federation of Rhodesia and Nyasaland.

A. I. Perera, C.B.E., *Vice-Chairman*, Ceylon.

W. C. Tame, United Kingdom.

Dr. J. G. Malloch, M.B.E., *Acting*, Canada.

W. Ives, M.Ec., Australia.

V. Armstrong, B.Sc., Ph.D., D.I.C., New Zealand.

E. D. Andrews, *Acting*, Union of South Africa.

P. N. Haksar, Counsellor (External Department) of the High Commissioner for India in the United Kingdom, India.

Vacant, Pakistan.

C. E. Lambert, C.M.G., Colonial Territories.

Sir Herbert Howard, *Secretary*, Farnham House, Farnham Royal, Nr. Slough, Bucks.

COMMONWEALTH INSTITUTE OF ENTOMOLOGY

Director and Editor.

W. J. Hall, C.M.G., M.C., D.Sc.

Assistant Director.

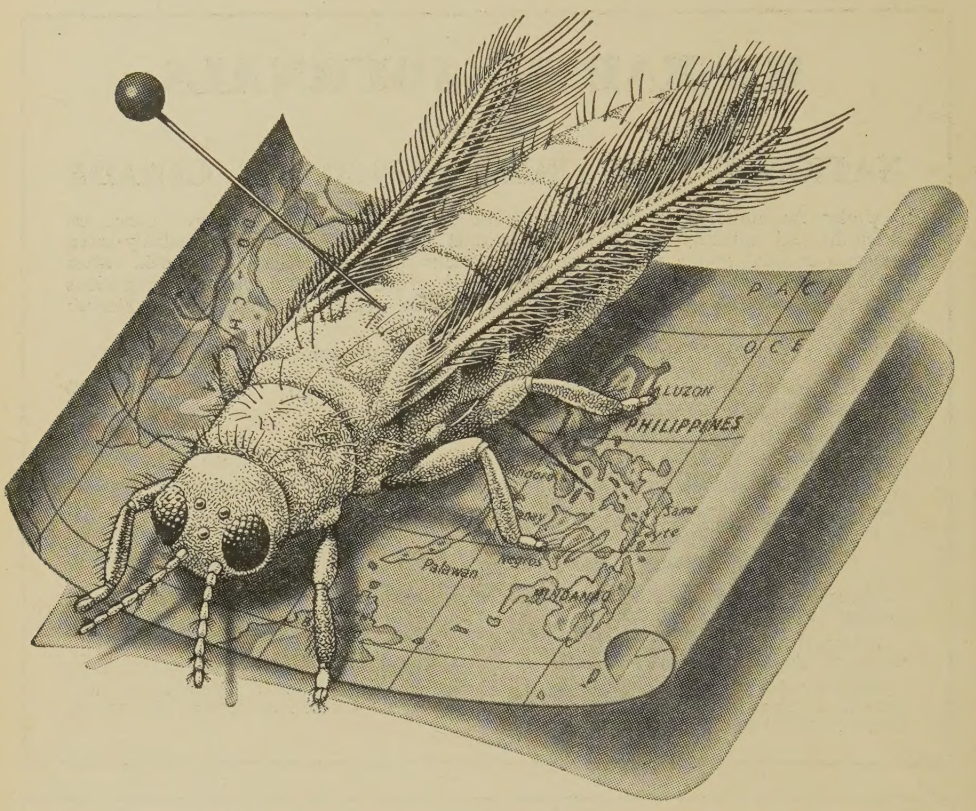
E. O. Pearson, B.A.

Assistant Editor.

H. S. Bushell, M.A.

Head Office—c/o British Museum (Natural History), Cromwell Road, London, S.W.7.

Publication Office and Library—56, Queen's Gate, London, S.W.7



The case of *Thrips tabaci*...

To the farmers in the Philippines onions have always been a very important crop. But in recent years they have become less and less worth growing, due to the onion thrips, *T. tabaci*, which breeds in millions and distorts the foliage so that it dies off early, and can only produce a small crop of undersized bulbs. The eggs hatch in five days; in a fortnight the life cycle is completed and further generations continue to appear as long as temperatures remain high. Not only onions are attacked; many other crops throughout the world are damaged by this tiny but not insignificant pest.

Despite control measures, onion thrips were having the best of the battle . . . until the arrival of dieldrin. Extensive field trials proved that this insecticide, one of the newer types developed by Shell, possesses the greater killing power and persistence needed to bring onion thrips under full control.

One spraying of dieldrin, at ½ lb., or even less to the acre, gives three to four weeks protection and, with the aid of dieldrin, onions are again a flourishing crop on the farms of the Philippines.

Dieldrin is one of the newer Shell insecticides, effective against a very wide range of insect pests which attack crops or spread disease. Its exceptional persistence, surer kill and lower dosages are now in the service of agriculture and public health throughout the world.

Aldrin — another recent Shell development — is fast becoming recognised as the best of all insecticides for the control of pests in the soil.

Is there an urgent pest problem in your *area?*

dieldrin

dieldrin and aldrin are SHELL insecticides for world-wide use

For further information apply to your Shell Company. *Issued by The Shell Petroleum Company Limited, London, E.C.3, England*

Gar (K. A.), Mandel'baum (Ya. A.), Mel'nikov (N. N.), Shvetsova-Shilovskaya (K. D.) & Chernetsova (V. I.). **The Application of the Method of labelled Atoms to the Study of the Resistance of *Eurygaster integriceps* Put. to two organic Phosphorus Insecticides and an Experiment on the Study of their Penetration into Plants.** [*In Russian.*] —*Dokl. Akad. Nauk SSSR* (N.S.) **94** no. 6 pp. 1189–1192, 1 graph, 5 refs. Moscow, 1954.

Ethyl di(p-nitrophenyl) thiophosphate, a non-volatile crystalline solid with a melting point of 125°C. referred to below as the ethyl compound, is obtained in the production of parathion. It is much less effective than the latter, and since the reason for this was not known, investigations were carried out in which adults of *Eurygaster integriceps* Put. were treated with 1 per cent. dusts of the two compounds prepared from radioactive phosphorus (P^{32}) and the amounts that entered their bodies were determined.

Two series of tests were carried out at different times with bugs collected at different places in the Soviet Union. In one series, 1·1 and 2·2 μg. parathion per gm. body weight were found in males and females, respectively, and 3·8 μg. of the ethyl compound in females that were still living, 2·1 μg. parathion and 5·8 μg. ethyl compound were found in males and 7·4 μg. parathion and 7·3 μg. ethyl compound in females that were paralysed, and 6·4 and 9·5 μg. parathion were found in males and females and 15·3 μg. ethyl compound in females that were killed by the treatment. In the other, 14·7 and 30 μg. ethyl compound were found in males and females still alive, 6·5 μg. parathion was found in males and 28·7 and 48·8 μg. ethyl compound in males and females that were paralysed, and 10·2 μg. parathion and 54·4 μg. ethyl compound were found in males and 10·9 μg. parathion and 56·9 μg. ethyl compound in females that were dead. These results indicate that there is a direct relation (within series) between the amount of phosphorus that enters the body and degree of poisoning, that females are more resistant to parathion than males (which was confirmed in a field test in which 1 per cent. parathion dust killed 60 per cent. of the females and 77·6 per cent. of the males on wheat), and that parathion is lethal to the bug at lower concentrations than is the ethyl compound. Differences in mortality were not due to differences in penetrating ability, since when dead individuals were treated, the amounts found to have entered them, though much reduced, were equal for the two sexes.

Attempts have been made to use parathion as a systemic insecticide, and investigations were therefore carried out on its penetration into and persistence in plants watered with emulsions of the radioactive compound. Analysis was based on the fact that parathion is soluble in organic solvents but not in water, whereas the phosphorus acids to which it is hydrolysed are water-soluble. In the main test, chrysanthemum plants in pots of soil were watered with 50 ml. 0·05, 0·1 or 0·2 per cent. parathion and infested with *Macrosiphum* (*Aulacorthum*) *pelargonii* (Kalt.). Even the strongest emulsion failed to give complete mortality of the Aphids, the amount of undecomposed insecticide in the plants reaching 20–30 mg. per kg. in 8–10 days and that of the total parathion reaching 60 mg. in 12 days, after which both values decreased. The lower concentrations were less effective and showed lower contents of total and undecomposed parathion. When plants that received the 0·2 per cent. emulsion were kept at a lower temperature in the shade, the parathion content reached 50 mg. per kg., and most of the Aphids died in two days, the equivalent of 22 mg. parathion per kg. live weight being found in those that dropped from the plants. In other tests, parathion penetrated into beet and cineraria to about the same degree as into chrysanthemums.

(1908) Wt. P8522/3895 9/55 E.P. Ltd. Gp. 566 [A]

When cabbage plants infested with *Brevicoryne brassicae* (L.) were watered with 0·025, 0·05 or 0·1 per cent. parathion emulsions, hydrolysis was rapid, only water-soluble products remaining after 30 days, and there was no Aphid mortality, though considerable amounts of the insecticide were taken up. The two higher concentrations caused drying of the leaves. In a final test, bean plants (*Phaseolus*) in a greenhouse protected from the sun were dusted in November with 1 per cent. radioactive parathion at the rate of 0·12 oz. per sq. yard. The amounts of total parathion shown by the leaves were 8·6, 13·5 and 3·6 mg. per kg. in 7, 16 and 23 days, respectively, but whereas 72 per cent. of it was unchanged after seven days, only 58 per cent. remained undecomposed after 16. When the test was repeated in May under conditions of bright sunlight, the whole of the parathion absorbed by the plants had decomposed in four days.

It is concluded that parathion is of little value as a systemic insecticide, owing to its insufficient penetration into plants and the rapidity with which it is hydrolysed in them. It would be useful, however, for the treatment of fruits and vegetables shortly before harvest, since there would be little risk of poisonous residues.

Berim (N. G.). **Peculiarities of the physiological Synergism of DDT and Fluorine Compounds in their Action on Insects.** [*In Russian.*]—*Dokl. Akad. Nauk SSSR* (N.S.) **95** no. 6 pp. 1359–1362, 7 refs. Moscow, 1954.

Since DDT acts on the nervous system of insects, it was thought that a synergistic effect might be obtained by the addition to it of substances that inhibit the action of cholinesterase. Sodium fluoride has been shown to inhibit cholinesterase and also to block the synthesis of acetylcholine, and tests were carried out in which fourth-instar larvae of *Lymantria* (*Porthetria*) *dispar* (L.) and fifth-instar larvae of *Malacosoma neustria* (L.) were dusted with 5 per cent. DDT, with sodium fluoride, or with a 1:1 mixture of the two. The rates of mortality and various physiological and biochemical indices of the larvae were determined and compared with those of untreated individuals. The larvae of *L. dispar* were the more susceptible, and the three treatments killed 100, 17·4 and 100 per cent. of them, respectively, in averages of 26, 53 and 7 hours. In the case of *M. neustria*, DDT and sodium fluoride alone gave no mortality in 24 hours, as compared with 90 per cent. for the mixture. The greater effect of the latter was shown by an increase in the intensity of respiration and reductions in weight, water content and cholinesterase activity, as compared with untreated larvae and those treated with either substance alone.

When fourth-instar larvae of *L. dispar* were dusted with mixtures of 2·5 per cent. DDT and 2·5, 5, 10 or 15 per cent. sodium fluoride, complete mortality resulted in 43, 42, 30 and 25 hours, respectively, the synergistic effect thus varying directly with the proportion of sodium fluoride in the mixture.

Synergism also occurred between DDT and technical sodium fluosilicate (which contains up to 5 per cent. sodium fluoride), though it was less pronounced than that between DDT and sodium fluoride. In tests with fifth-instar larvae of *M. neustria*, sodium fluosilicate alone gave no mortality, 5 per cent. DDT killed 90 per cent. in 55 hours, and a 1:1 mixture of the two gave complete mortality in 51 hours. The corresponding figures for fourth-instar larvae of *L. dispar* were 88, 100 and 100 per cent. mortality in 49, 59 and 21 hours.

Descamps (M.). **Observations relatives au criquet migrateur africain et à quelques autres espèces d'Acridae du Nord-Cameroun.**—*Agron. trop.* **8** no. 6 pp. 567–613, 50 figs., 2 maps, 16 refs. Nogent-sur-Marne, 1953.

The observations described were made in 1952 in a low-lying area in French Equatorial Africa to the south of Lake Chad [*cf. R.A.E.*, A **22** 619; **27** 570] suspected of providing favourable conditions for the formation of swarms of *Locusta migratoria migratorioides* (R. & F.). The area is traversed throughout most of its length by the river Logone and is subject to extensive flooding in August–November. The soils, rainfall, vegetation and flood régime are described, and accounts are given of the seasonal distribution, development, sex ratios and biometrics of solitary *L. m. migratorioides* and of the seasonal distribution and development of *Nomadacris septemfasciata* (Serv.), with a table showing the local distribution of 93 other species of Acridids observed during the work and notes on the seasonal occurrence of 28 of them.

The movements of *L. m. migratorioides* were closely correlated with the rise and fall of the floods in the Logone valley. The adults occurred in small numbers near water during March–April, scattered over the inundation area in June, when the first rains occurred, and in August, when the floods began, dispersed to dry situations where they remained till the recession of the floods in October in the south and November in the north. During the succeeding dry season, they gathered in the inundation area, where they were more numerous than in June. Females that survived the dry season oviposited during April–July, with a peak in May, and young females were abundant in June–July, but did not begin to mature until the end of the rains in the latter part of August. Most were mature by the beginning of October, and oviposition continued from then until the end of December, reaching a peak in October among those females that remained in the dry situations where they had spent the flood period and at the end of November or the beginning of December among those that migrated to the inundation area. Immature females of the second generation were most abundant at the end of December. A partial third generation developed along one tributary where the floods occurred almost two months later than in the main valley. From comparisons of conditions in the area under consideration and in the Niger outbreak area of *L. m. migratorioides* [**27** 13, etc.] and of the behaviour of the locusts within them, it is concluded that the two areas show great similarity; the development of a third generation, which occurs in the Niger valley, is in general prevented in the Logone valley by excessive rainfall during July–August.

Adults of *N. septemfasciata* were widely scattered in dry situations throughout the area at the beginning of the rains, but from September–January the adults of the next generation were confined almost exclusively to a part of the Logone valley and a part of another valley in the south of the area; the eggs laid elsewhere were evidently destroyed by early flooding. These adults were dispersed during the dry season by bush fires and the passage of herds. Oviposition took place during July and, to a less extent, August; young adults were present during September–November, and mature ones from January till August.

Hickin (N. E.). **Woodworm: its Biology and Extermination.**—9 × 5½ ins., 84 pp., 91 figs., 35 refs. London, the Author, 1954. Price 10*s.* 6*d.*

This handbook is intended largely for those with little knowledge of entomology and deals with conditions in Britain. It opens with a brief

survey of the various agencies that cause decay of wood (including structural timbers and furniture) in buildings and contains six chapters on the Coleoptera mainly responsible for damage. The beetles are described, their bionomics are explained, the timbers attacked are indicated, and information is given on natural enemies and the prevention and control of infestation, emphasis being laid throughout on practical aspects of the subject. *Anobium punctatum* (Deg.) is stated to cause some 80 per cent. of all the damage in Britain attributable to woodworm, and *Lyctus* and *Xestobium rufovillosum* (Deg.) about 8 per cent. each. The final chapters contain notes on marine borers, termites (which are not known in Britain) and insects that might be mistaken for wood-boring beetles.

Stride (G. O.). **On the Nutrition of *Carpophilus hemipterus* L. (Coleoptera: Nitidulidae).**—*Trans. R. ent. Soc. Lond.* **104** pt. 6 pp. 171–194, 11 graphs, 8 refs. London, 1953.

The following is almost entirely the author's summary. A technique is described for rearing larvae of *Carpophilus hemipterus* (L.) on artificial diets under sterile conditions. The larvae did not survive on the normal culturing medium of boiled dates unless living micro-organisms or large amounts of dried yeast were present. A relatively high water content in the diet was necessary for rapid growth. On diets with a low water content, the mortality rate was high and the pupae small. After water extraction, dried yeast still contained one and possibly two factors that were apparently essential to the larvae. Riboflavin, nicotinic acid and pantothenic acid were found to be essential for growth and survival. Pyridoxin was essential for survival, and choline chloride was essential for growth. On certain artificial foods, based on dried yeast from which the common natural sterols were almost entirely extracted, the growth rate was increased by the addition of cholesterol or ergosterol.

Trouillon (L. L.). **Mise au point d'une nouvelle méthode de traitements insecticides des luzernes.**—*Phytoma* **7** no. 61 pp. 12–15, 2 figs., 1 ref. Paris, 1954.

In preliminary experiments in southern France in 1953, treatment of lucerne fields in January with 27 lb. 25 per cent. BHC dust in 270 lb. superphosphate per acre, and subsequent harrowing, gave promising control of *Colaspidema atrum* (Ol.) and weevils of the genera *Apion* and *Hypera*. The experiments were extended in the following year, and the results showed that winter treatments with 5·4–6·3 lb. BHC per acre mixed with the fertiliser was sufficient to protect the lucerne throughout the season, provided that all lucerne fields in the area were treated, so that reinfestation was prevented. There is a risk that crude BHC might taint subsequent root crops.

Targe (A.). **Remarques sur les tétranyques et leurs traitements dans les régions méditerranéennes.**—*Phytoma* **7** no. 61 pp. 21–22, 1 fig. Paris, 1954.

Increasing damage has been caused in southern France in recent years by *Bryobia practiosa* Koch on peach and *Citrus*, *Paratetranychus pilosus* (C. & F.) (*Metatetranychus ulmi*, auct.) on peach and *Tetranychus telarius* (L.) (*althaeae* v. Hanst.) on rose, asparagus and particularly carnations.

Vasates lycopersici (Massee) (*destructor* (Keifer)), which had not previously been recorded from France, was identified on tomato in Bouches-du-Rhône in 1953, and an unidentified species of *Tetranychus* (*Eotetranychus*) attacked vines in the same year from the Department of Pyrénées-Orientales to Vaucluse. The factors favouring the increase of infestation by mites are discussed, and probably include the destruction of predators and an increase in the rate of reproduction due to repeated treatment with DDT [*cf. R.A.E.*, A **43** 83] applied against *Cydia* (*Laspeyresia*) *molesta* (Busck) and *Ceratitis capitata* (Wied.) on peach and of DDT in white oil on *Citrus*. In areas where DDT is not used and only DNC in oil is applied to peach, the mites have not increased.

Delucchi (V.), Tadić (M.) & Bogavac (M.). **L'élevage en masse de *Apanteles plutellae* Kurdj. (Hym., Braconidae) et de *Angitia tibialis* Grav. (Hym., Ichneumonidae), parasites endophages de *Plutella maculipennis* Curt., et notes biologiques sur ces parasites.**—*Plant Prot.* no. 21 pp. 20–41, 2 pls., 6 figs., 12 refs. Belgrade, 1954. (With a Summary in Croatian.)

In 1951, larvae and cocoons of *Plutella maculipennis* (Curt.) were collected in the district of Versilia, on the coast of Tuscany, for investigation of their parasites and rearing of the latter for despatch to Australia. The district was chosen because it had a climate resembling that of southern Australia and the fields were seldom treated with insecticides. The species obtained were *Apanteles plutellae* Kurd., *Angitia tibialis* (Grav.) and *Thyraeella* (*Diadromus*) *collaris* (Grav.). The last afforded not more than 2 per cent. parasitism in the field, was little more effective in the laboratory, and appeared to be at the southern limit of its European distribution. *A. tibialis* was abundant in the field and gave 57·9–78·03 per cent. parasitism between July and September. *Apanteles plutellae* was less frequent and gave 10·8–18·3 per cent. parasitism. Two hyperparasites emerged, *Mesochorus facialis* Bridgm. from 25 per cent. of *A. plutellae*, and *Tetrastichus* sp. from 15 per cent. of *Angitia*. The presence of these rendered it necessary to breed parasites in the laboratory for despatch. Host larvae were reared on cabbage from field-collected adults, and *Apanteles* and *Angitia* were reared on them by a method resembling that previously used for rearing *Apanteles rubecula* Marsh. on *Pieris rapae* (L.) [*cf. R.A.E.*, A **41** 177]. The host larvae were exposed to the females of *Apanteles* in the second instar, and to those of *Angitia* in the third or fourth.

The eggs, larvae and pupae of *Apanteles plutellae* and the eggs of *Angitia tibialis* are described. Total development of *Apanteles* lasted 11–16 days, with an average of 13·5 days, at an average temperature of 25°C. [77°F.], the egg, larval and pupal stages lasting 36–38 hours, eight days and about 4·5 days, respectively. Many eggs were laid in each host, but only one larva developed, all the others dying soon after hatching. The host larvae died a few hours after the parasite larvae had left them to pupate. *A. plutellae* is known to parasitise larvae of *Hyphantria cunea* (Dru.) in Yugoslavia [*cf.* **43** 176], but, in tests with some of its other recorded hosts [*cf.* **27** 505], it did not attack *Pieris rapae* or *P. brassicae* (L.). At 23°C. [73·4°F.], the larvae of *Angitia tibialis* hatched in 42–49 hours, with an average of 45, but only one completed its development per host. The larval stage lasted about 6·5 days, and the pupal stage about 8·5–11·5 days, with an average of 9·5.

Cocoons of *Apanteles* and *Angitia* on muslin were despatched to Australia by air in the autumn, in special boxes, which are described, and arrived in good condition. A few adults of *T. collaris* were also sent.

Živanović (V.). **Biologija šljivinih osa u zapadnoj Srbiji.** [The Biology of Plum Sawflies in western Serbia.]—*Plant Prot.* no. 21 pp. 48–60, 1 fig., 3 graphs, 9 refs. Belgrade, 1954. (With a Summary in English.)

Hoplocampa minuta (Christ) and *H. flava* (L.), the life-histories of which are very similar, cause serious damage to plums in western Serbia, the losses of fruit ranging up to 70 per cent. The immature stages of these sawflies are briefly described, and an account is given of observations on their bionomics and control carried out in 1950–53. In spring, the adults emerged from the soil at the time when the petals of early plums were beginning to separate, the date ranging from 19th March to 10th April. Females outnumbered males, and *H. minuta* was the predominant species. At 15–22°C. [59–71·6°F.] and a relative humidity of 75–80 per cent., the males lived for an average of 3–10 days and the females for 5–19. In the laboratory, they fed on the pollen and nectar of various species of *Prunus*, but eggs were laid only on plum and *P. spinosa*, and only these two species were damaged in the field. The females laid about 10–30 eggs each in the laboratory, with a maximum of 62, and about 20 in the field. They were usually inserted into the outer part of the sepals and hatched in 8–11 days in the field, and in five days in the laboratory at 20°C. [68°F.]. The larvae entered the ovaries and became full-fed in 23–25 days, during which time they each attacked 4–6 fruits, which subsequently dropped. The full-fed larvae overwintered in cocoons in the soil at a depth of 2–6 ins. and pupated in the following spring, the pupal stage lasting 15–20 days. The larvae in their cocoons were resistant to low temperature, but sensitive to drought. Those exposed to −20°C. [−4°F.] in the soil did not survive.

No parasites were observed, but larvae apparently killed by a fungus were occasionally found in the fruits, and some of the cocoons were destroyed by predators. In tests on control, sprays of DDT applied before flowering against the adults and after it against the larvae did not give sufficient protection, but treatments applied when 50–60 per cent. of the petals had fallen gave good results, the percentage infestation being reduced from 72·2 for no treatment to 3·1 and 0·3 by dusts of 0·2 and 0·4 per cent. γ BHC, 0·3 and 0·1 by sprays of 0·4 and 0·5 per cent. γ BHC, 1·5 by 0·3 per cent. Pestox 3 [which contains schradan (*cf. R.A.E.*, A **40** 147)], 0·06–0·4 by 0·025–0·075 per cent. parathion, and 6·02 by 1 per cent. DDT.

Distribution Maps of Insect Pests.—Series A, nos. 49–54. London, Commonw. Inst. Ent., 1955.

These maps are nos. 49–54 of a series already noticed [*R.A.E.*, A **40** 203; **42** 378] and deal, respectively, with *Lepidosaphes beckii* (Newm.), *Dysmicoccus brevipes* (Ckll.), *Icerya purchasi* Mask., *I. seychellarum* (Westw.), *Laphygma exempta* (Wlk.) and *Oryctes rhinoceros* (L.).

Bagnall (R. H.). **The Spread of Potato Virus Y in Seed Potatoes in Relation to the Date of Harvesting and the Prevalence of Aphids.**—*Canad. J. agric. Sci.* **33** no. 6 pp. 509–519, 17 refs. Ottawa, 1953.

The following is substantially the author's summary. In order to determine the effect of controlling Aphids with DDT and of early harvesting of potatoes on the spread of potato virus Y in the Fredericton district of New Brunswick, two-row plots of potatoes, arranged in Latin squares, were grown in 1949 and 1950. The plots were interspaced with rows of potatoes infected with virus Y. Some of the plots were sprayed repeatedly with

wettable DDT at 1 lb. in 100 gals. water per acre, and others were left untreated as checks. A 100-tuber sample was saved from each plot and planted the following year for disease records.

The percentage infection among the tubers reached 7 by 10th August in 1949 and 19 by the same date in 1950, and gradually increased to 14·3 by 14th September in 1949 and 32·3 in 1950. Aphids [*cf. R.A.E.*, A **43** 133] were first detected on 26th July in both years, and maximum populations occurred early in September. Aphid numbers were greatly reduced in the treated plots in comparison with those in the check plots, but the spread of virus Y was not lessened. Much of the spread had already occurred well before maximum Aphid populations had been reached. The proportion of seed tubers infected, and the activity and probably the species of Aphids present during different periods of the season, appear to have more bearing upon the spread of potato virus than does the total number of Aphids.

The results indicate that early harvesting of potatoes to control virus Y would not be an economical method in the Fredericton district. On the other hand, early and thorough rogueing of infected plants and of adjacent, apparently healthy, plants is indicated as the means of controlling the virus.

Bird (F. T.) & Whalen (M. M.). **A Virus Disease of the European Pine Sawfly,** *Neodiprion sertifer* **(Geoffr.).**—*Canad. Ent.* **85** no. 12 pp. 433–437, 6 figs., 8 refs. Ottawa, 1953.

An account is given of laboratory investigations on the polyhedral virus disease of *Neodiprion sertifer* (Geoffr.) that was introduced into Ontario from Sweden [*cf. R.A.E.*, A **34** 130] and used in control experiments [*cf.* next abstract, etc.]. Suspensions of the polyhedra were prepared by allowing larvae killed by the virus to rot in water for several months, purifying the polyhedra in the sediment by repeated centrifuging and washing, and suspending them in sterile distilled water. Larvae fed on foliage of Scots pine [*Pinus sylvestris*] that had been sprayed with a suspension containing 50 million partially purified polyhedra per ml. all died in 4–10 days unless they were ready to construct their cocoons [*cf.* **42** 222]. From the results of a test in which larvae that had been starved for 24 hours ingested 0·5 mml. suspension containing 5, 50, 500 or 5,000 purified polyhedra, the median lethal dose was estimated to be 100–500 polyhedra; larvae that received the three highest doses all died in 6–16 days. The polyhedra occurred only in the nuclei of the digestive cells of the mid-gut epithelium [*cf.* **42** 222], where they were first observed 48 hours after ingestion. The number of frass pellets dropped by the larvae decreased at about the same time. The polyhedra and the internal symptoms of infection are briefly described.

Bird (F. T.). **The Use of a Virus Disease in the Biological Control of the European Pine Sawfly,** *Neodiprion sertifer* **(Geoffr.).**—*Canad. Ent.* **85** no. 12 pp. 437–446, 5 figs., 11 refs. Ottawa, 1953.

Plantations of Scots pine [*Pinus sylvestris*] infested by *Neodiprion sertifer* (Geoffr.) in southern Ontario were sprayed experimentally during 1950–52 with suspensions of a polyhedral virus introduced from Sweden [see preceding abstract], to determine its value in control. The principal results obtained in the first two years have already been noticed [*cf. R.A.E.*, A **41** 22; **43** 185]. In 1952, 22 gals. suspension containing five million polyhedra per ml. with the addition of skim-milk powder as an adhesive, applied from a Piper Cub aeroplane equipped with a boom-type sprayer that flew along parallel lines about 200 ft. apart, killed all the larvae in over 94 per cent. of

the colonies over an area of 50 acres within 21 days, and some of them in a further 4·8 per cent. In another test, in which the flight lines were 300 ft. apart and suspensions containing 200,000, a million or five million polyhedra per ml. were applied at a rate of about ½ gal. per acre, the highest concentration caused mortality over a considerably greater area than the other two and nearly all the trees bore some virus-killed larvae. After 20–23 days, this concentration resulted in a swathe 200 ft. wide in which defoliation did not exceed 40 per cent., whereas concentrations of 200,000 and a million polyhedra per ml. gave similar degrees of protection over swathes of only 80 and 110 ft., respectively. Without treatment, defoliation would have been almost complete.

The tests as a whole showed that mortality was higher and more rapid where greater amounts of polyhedra were deposited. When applications were made by mist-blower [**43** 185], mortality first occurred near the spray source, and with both mist-blower and aeroplane the area with infected larvae increased each day. The larvae died faster on the top branches of tall trees than on the bottom ones, and the addition of skim milk to the spray hastened mortality. The larvae became infected partly by ingesting the sprayed foliage and partly by contact with infected larvae. A test in which the virus spread in an uninfected plantation after being smeared on the trunk of one tree indicated that it can be disseminated by agents such as birds and scavenging, predacious or parasitic insects, though these probably cause little spread in the year in which the application is made. As mortality does not occur until eight days after the application of the virus, this is best applied when the eggs are hatching or shortly afterwards, so as to obtain the maximum mortality and the least defoliation. It is possible to kill a high percentage of the larvae by means of the virus in one year, but, by judicious application, serious defoliation can be prevented and sufficient larvae left to carry over the disease from year to year and to enable other control agents, notably parasites, to survive.

Blais (J. R.). **Effects of the Destruction of the current Year's Foliage of Balsam Fir on the Fecundity and Habits of Flight of the Spruce Budworm.**—*Canad. Ent.* **85** no. 12 pp. 446–448, 7 refs. Ottawa, 1953.

In view of laboratory findings that females of the spruce budworm [*Choristoneura fumiferana* (Clem.)] reared from larvae fed on old foliage of balsam fir [*Abies balsamea*] during the fifth and sixth instars laid fewer eggs than those reared on foliage of the current year [*R.A.E.*, A **40** 303], field studies were made in north-western Ontario in 1950–52 to discover whether fecundity was affected in the same way in the field. Branches bearing pupae were collected from infested stands of *A. balsamea*, the pupae were transferred to cages, and the numbers of eggs laid by the resulting fertilised females were correlated with the degree of defoliation of the current year's growth of the original branches. In every case, significantly fewer eggs were laid by females from trees on which defoliation was complete before the end of the larval stage than by females from those on which it was not, the means being 96–127 and 157–182, respectively, with no significant difference from year to year.

Fully gravid females have been stated to be unable to fly until they have deposited some eggs [**38** 5], but, in the present studies, gravid females reared on old foliage or in areas of severe defoliation, which are often undersized, were able to fly upwards soon after emergence. The mass flights of *C. fumiferana* reported at times near heavily infested forests possibly consist of undersized adults that take flight shortly after emergence and are transported in the manner suggested for partly spent females [**40** 300].

Pickett (A. D.) & Patterson (N. A.). **The Influence of Spray Programs on the Fauna of Apple Orchards in Nova Scotia. IV. A Review.**— *Canad. Ent.* **85** no. 12 pp. 472–478, 19 refs. Ottawa, 1953.

In this part of a series dealing with long-term investigations of the effects of sprays on the arthropod fauna of apple orchards in Nova Scotia [*cf. R.A.E.*, A **43** 71, etc.], the author reviews the aims and methods of the work and some of the results achieved in the earlier years and discusses the findings with regard to future control practice. Following the discovery that the substitution of copper fungicides and ferbam [ferric dimethyl dithiocarbamate] for sulphur permitted natural enemies to control *Lepidosaphes ulmi* (L.) [**36** 392], most growers ceased using sulphur fungicides and this Coccid is now of very minor importance. DDT, parathion, arsenicals and sulphur fungicides were all detrimental to natural enemies of *Spilonota ocellana* (Schiff.). Populations of this pest remained low in orchards in which no insecticides were applied for 14 consecutive years and fungicides for the past nine, and its numbers fell sharply in many orchards that had received regular applications of insecticides and fungicides when the use of the insecticides was discontinued. It is not known whether natural enemies alone can provide permanent economic control over the whole of the Annapolis Valley, but it is notable that outbreaks occur only in sprayed orchards.

The results for *Cydia* (*Carpocapsa*) *pomonella* (L.) indicate that sprays against it should be kept at a minimum. The extensive use of sulphur and, to a less extent, copper fungicides is detrimental to the egg predators, *Haplothrips faurei* Hood [**42** 171] and *Leptothrips mali* (Fitch), but the glyoxalidine compound now used [*cf.* **42** 171] and ferbam did not suppress predators on which they were tested. Ferbam may be detrimental to the fungus, *Beauveria globulifera*, which exerts fairly effective control under some conditions. Lead arsenate is harmful to the parasite, *Ascogaster quadridentata* Wesm., and the predacious mite, *Anystis agilis* Banks, and DDT and parathion are highly toxic to many natural enemies of the moth. In five experimental orchards in which sprays against *C. pomonella* were discontinued for 4–13 years, damage was generally 5–15 per cent. and did not exceed 20 per cent.; furthermore, populations of *C. pomonella* tended to fall as the number of insecticidal applications in the whole area decreased. Many growers have adopted modified spray programmes eliminating insecticides or including only one or two applications against Aphids and Lepidoptera other than *C. pomonella* with very satisfactory results, though where DDT was previously used, populations of *C. pomonella* sometimes increased during the second and third years. In many orchards, total insect damage to the fruit fell to 10 per cent. in the fourth year. Some growers reduced *C. pomonella*, without interfering with natural control, by means of sprays of fixed nicotine; ryania also shows promise for this purpose.

In discussing the results, the author states that no programme of pest control, with or without the use of insecticides, is completely reliable, and that losses of 20 per cent. due to *C. pomonella* are preferable to programmes including DDT or the extensive use of lead arsenate, with their attendant complications. Systemic insecticides are unlikely to be of value in programmes combining chemical and biological control [*cf.* **39** 375], since they destroy large numbers of phytophagous insects that would otherwise sustain effective populations of parasites and predators. The investigations support the hypothesis that pests such as *S. ocellana*, for which ample food supplies are almost always available, do not become abundant in the absence of chemical control since general predators feed on them either incidentally or by preference.

Black (L. M.). **Occasional Transmission of some Plant Viruses through the Eggs of their Insect Vectors.**—*Phytopathology* **43** no. 1 pp. 9–10, 6 refs. Baltimore, Md., 1953.

The following is based on the author's summary. Females of *Agalliopsis novella* (Say) reared on crimson clover (*Trifolium incarnatum*) infected with wound-tumour virus (*Aureogenus magnivena* of Black) [*cf. R.A.E.*, A **43** 269] gave rise to about 1·8 per cent. of infective progeny. Evidence was obtained that occasional females transmit the virus to a much higher percentage of their offspring. Females of *Agallia constricta* Van D. reared on *T. incarnatum* infected with New Jersey potato yellow-dwarf virus (*Aureogenus vastans* var. *agalliae* of Black) gave rise to about 0·8 per cent. of infective progeny.

Simons (J. N.) & Sylvester (E. S.). **Acquisition Threshold Period of Western Celery Mosaic Virus for four Species of Aphids.**—*Phytopathology* **43** no. 1 pp. 29–31, 22 refs. Baltimore, Md., 1953.

The following is taken from the authors' summary. Experiments were undertaken in California to determine the acquisition threshold period of western celery mosaic virus [*cf. R.A.E.*, A **27** 590] for *Myzus persicae* (Sulz.), *Macrosiphum* (*Myzus*) *solani* (Kalt.), *Myzus circumflexus* (Buckt.) and *Aphis apii* Theo. None of the Aphids acquired the virus from celery in a five-second feeding period, but all four did so in ten seconds. *M. circumflexus* was the most efficient vector of the virus to celery, and *M. persicae* and *A. apii* were the least. A 15-second acquisition feeding period was optimum for *M. circumflexus*, and a 20-second period for *M. solani*; the optimum periods for the other species were not determined.

Sylvester (E. S.). *Brassica nigra* **Virus Transmission. Some Vector-Virus-Host Plant Relationships.**—*Phytopathology* **43** no. 4 pp. 209–214, 1 fig., 25 refs. Baltimore, Md., 1953.

The *Brassica nigra* virus was described by W. N. Takahashi from black mustard (*B. nigra*) in 1949 and subsequently found to be transmitted by Aphids. It proved to be of the non-persistent type. Experiments were carried out in California on the effect of various factors on transmission by *Myzus persicae* (Sulz.), the plant used being the smooth-leaf mustard (*Brassica juncea*), and the following is based on the author's summary of the results. Experimental variations in transmission resulted from differences among plants, insect colonies and virus sources, but fairly uniform results were obtained when one Aphid colony and a single leaf virus source were used to infect one group of uniform test plants on the same day within two hours. Although the Aphids most frequently fed on the lower surface of the mustard leaves, there was little difference in susceptibility to infection among the various tissue regions. Keeping seedlings in the dark for 24 or 48 hours prior to inoculation did not increase susceptibility when virus was introduced by insects restricted to a ten-second feeding period, and there was no difference in susceptibility among plants 1–5 weeks old. The concentration of virus in the leaves was studied for various periods, and the ratio of active virus to amount of tissue appeared greatest some 15–20 days after inoculation. In all leaves, the active virus concentration apparently went through a typical growth cycle; it was low in old leaves and fairly high in younger leaves of the same plant. The advantages and disadvantages of using insects to determine relative active virus concentration in plants are very briefly discussed.

Sylvester (E. S.). **Aphid Transmission of nonpersistent Plant Viruses with special Reference to the *Brassica nigra* Virus.**—*Hilgardia* **23** no. 3 pp. 53–98, 5 pp. refs. Berkeley, Cal., 1954.

The following is based on the author's summary of this account of further investigations in California on the transmission of the *Brassica nigra* virus by Aphids [*cf.* preceding abstract]. The plants used were seedlings of smooth-leaf mustard (*Brassica juncea*). *Myzus persicae* (Sulz.) was the principal vector tested, but *Rhopalosiphum pseudobrassicae* (Davis) was included in some of the experiments.

The probability of infecting the healthy test plants was greater for *M. persicae* when the acquisition feeding period on the infected plant was completed normally than when it was terminated prematurely, but was not affected by interruption of the feeding period on the healthy test plant. Preliminary fasting before a short acquisition feeding period increased the efficiency of both Aphids in transmitting the virus; *M. persicae* was the better vector and responded to fasting within five minutes, whereas the beneficial effects of preliminary fasting were not noticeable with *R. pseudobrassicae* for four hours. Post-acquisition fasting for five minutes decreased the level of infectivity in *M. persicae*; the data on *R. pseudobrassicae* were insufficient for comparative purposes, but no gain in efficiency occurred as a result of any post-acquisition fasting interval tested. Lowering the temperature from 22°C. [71·6°F.] to 5°C. [41°F.] decreased the rate of loss of efficiency due to post-acquisition fasting and also the rate of gain in efficiency due to preliminary fasting.

When *M. persicae* was forced to make a series of separate stylet penetrations, up to four 15-second acquisition feeding periods caused little increase in the proportion of test plants infected, but five or more tended to increase it. Serial transmission tests, in which 30 examples of *M. persicae* were allowed one, five or ten 15-second acquisition feeding periods each and were then transferred singly to 20 healthy plants in succession, indicated that dispersal of the virus charge by individuals was somewhat random. The numbers of plants infected were 31, 50 and 47, respectively, out of approximately 600; 12, 21 and 21, respectively, of the insects became infected and they transmitted the virus to averages of 2·58, 2·38 and 2·23 plants each.

Access period, defined as the time during which a vector has access to a virus source, though feeding may not occur throughout it, was found to affect the efficiency of transmission by *M. persicae*. A 15-minute access period and a controlled 15-second acquisition feeding period resulted in approximately equal efficiency, an access period of five minutes was the most favourable of all tested, and increasing the access period beyond 15 minutes was detrimental to vector efficiency. Records of the activity of Aphids during a five-minute access period indicated that an average of 3–4 punctures was made and that most feeding periods were longer than 15 seconds. This increased feeding activity may account for some of the gain in transmission efficiency over that due to a single 15-second feeding. Use of access periods varying from five minutes to 24 hours indicated that few if any Aphids were infective after feeding on an infected plant for four hours or more.

Studies of the loss of virus by *M. persicae* during feeding and during fasting indicated that infective Aphids feeding on a healthy plant lost the virus more rapidly than those that fasted. Feeding insects retained the virus for a maximum of 30 minutes and fasting ones for three hours. Serial transmission tests designed to determine variations in virus charge among individual Aphids indicated that the average per individual was approximately the same whether the insect fed for 15 seconds or had an access period of five minutes. In tests in which Aphids that had fed on the source plant were transferred to test plants after 0, 15, 30, 60, 120 or 180 minutes of fasting,

individuals that had had a five-minute access period retained the virus for longer (60 minutes), and lost proportionately less per test interval, than those that had had either one 15-second acquisition feeding or five separate 15-second acquisition feedings, which retained it for 15 minutes. There were indications that post-acquisition fasting might be used as a more critical test for determination of virus charge than that of serial transmission.

The paper concludes with a detailed review of the literature on the relation to the transmission of non-persistent viruses by Aphids of the method of feeding of the insects and their age, form and numbers, the acquisition, inoculation and transmission threshold periods, preliminary and post-acquisition fasting and the length of the acquisition feeding period; also of multiple stylet penetrations, serial transmission, virus charge, vector efficiency and specificity and virus retention; and of variations in temperature, light, humidity, and infected and test plants. Hypotheses concerning the mode of transmission are discussed, and it is suggested that transmission of non-persistent viruses by Aphids is in essence mechanical, vector efficiency and specificity being determined by compatibility factors that depend on specific interactions between the viruses, the saliva of the Aphids and the contents of the plant cells inoculated.

Oswald (J. W.) & Houston (B. R.). **The Yellow-dwarf Virus Disease of Cereal Crops.**—*Phytopathology* **43** no. 3 pp. 128–136, 3 figs., 26 refs. Baltimore, Md., 1953. **Host Range and Epiphytology of the Cereal Yellow Dwarf Disease.**—*T. c.* no. 6 pp. 309–313, 2 figs., 5 refs.

The following is based on the authors' summaries of these two papers.

Yellow dwarf, a new and damaging disease of cereals, occurred in epiphytotic proportions in California in 1951. The severity of symptoms and ultimate effect on yield of barley, wheat and oats depend on the age of the plants when infected. A characteristic of yellow dwarf on barley is a golden yellowing of the leaves accompanied by moderate to severe stunting. On infected oats, stunting, leaf reddening and head blasting occur. Wheat infected in the seedling stage is chlorotic and severely dwarfed. Infection at later growth stages induces a yellowing of the upper leaves of barley and wheat and a corresponding reddening of oats. Yellow dwarf is caused by a virus that could not be transferred by mechanical means but which was readily transmitted by Aphids. All five grain-infesting Aphids tested, *Macrosiphum avenae* (F.) (*granarium* (Kby.)), *M. dirhodum* (Wlk.), *Aphis* (*Rhopalosiphum*) *maidis* Fitch, *Rhopalosiphum prunifoliae* (Fitch) and *Toxoptera graminum* (Rond.), proved to be vectors. Tests with non-viruliferous Aphids of all five species eliminated direct Aphid injury as the cause of the disease. The virus persisted for up to 120 hours in the Aphid vectors. All attempts to transmit yellow dwarf through seed and soil gave negative results. Four varieties of barley were found to be highly resistant, two of barley and two of oats tolerant, and three of barley and two of oats, extremely susceptible to the disease. Studies on barley showed a direct correlation between the time of infection and effect of yellow dwarf on yield of grain. Yield was reduced by 95 per cent. in barley of three varieties naturally infected at the seedling stage in the field.

Inoculation studies showed that yellow dwarf has a wide range of host plants. Of 55 species of grasses tested, 36 became infected. Of these, 20 exhibited typical yellow-dwarf symptoms of stunting and either yellow or red leaf discoloration, and 16 showed no symptoms. Natural winter and spring range growth in California is made up principally of grasses susceptible to yellow dwarf, and many of the grasses grown in summer-irrigated pastures

are also among its hosts. Conditions favouring a damaging outbreak comprise a warm but continuously wet winter favouring rank growth of wild grasses and rapid reproduction of the Aphid vectors but delaying sowing of grain until March; a sudden long dry period after the rains, which brings about rapid drying of wild grasses soon after the grain is seeded; and large flights of Aphids from the drying grasses into very young grain fields. In the season of 1950–51, when damage was severe, Aphid flights apparently occurred in late March and early April from the grasses to young grain sown after 1st March. Yellow dwarf was as widespread in 1951–52, but Aphid flights from the grasses occurred in late April, when the grain, which had mostly been sown in December, was approaching heading. Losses from infection at this stage were slight.

Brakke (M. K.), Maramorosch (K.) & Black (L. M.). **Properties of the Wound-tumor Virus.**—*Phytopathology* **43** no. 7 pp. 387–390, 15 refs. Baltimore, Md., 1953.

The wound-tumour virus (*Aureogenus magnivena* of Black) induces vein enlargement on a wide variety of plants in the United States. It also causes root tumours on many of these and stem tumours on a few, and wounds seem to play a part in the initiation of the tumours. It is transmitted by Jassids, has a long incubation period in them and can be transmitted from cell-free extracts to them by injection with a fine glass needle. This last property was used in a study of some of its characteristics.

Extracts prepared from examples of *Agalliopsis novella* (Say) and *Agallia constricta* Van D. that had fed on infected crimson clover (*Trifolium incarnatum*) and extracts from infected *T. incarnatum* and *Melilotus alba* were injected into uninfected examples of *A. constricta* that were caged on a non-susceptible plant (lucerne) for three weeks and then on *T. incarnatum*, and the disease was transmitted to the latter from all four sources. Extracts from *T. incarnatum* were infective at a dilution of 10^{-4}, and those from *A. constricta* at 10^{-5}. When the insect extracts were dried and stored at 0°C. [32°F.], the virus survived for 12 months. Crude, neutral extracts retained their infectivity after being heated for ten minutes at 50°C. [122°F.] but not after ten minutes at 60°C. [140°F.]. Extracts were infective when stored at pH 4–9 for an hour at 0°C., but not when stored under more alkaline or more acid conditions. The virus was successfully passed through bacteria-retaining filters.

Brierley (P.), Smith (F. F.) & Doolittle (S. P.). **Experiments with Tomato Aspermy Virus from Chrysanthemum.** (Abstract.)—*Phytopathology* **43** no. 7 p. 404. Baltimore, Md., 1953.

In experiments, the virus of tomato aspermy [*cf. R.A.E.*, A **38** 148] infected 34 of 73 plant species tested. It was damaging to tomato, pepper [*Capsicum*], lettuce and spinach, and produced primary lesions or no infection in cucumber. Mottling developed on most varieties of chrysanthemums actively growing, but was later masked, and no flower distortion appeared on 13 varieties. The flowers of China aster [*Callistephus*] were distorted. Four species of Aphids transmitted the virus in the non-persistent manner. *Myzus persicae* (Sulz.) transmitted it from chrysanthemum to chrysanthemum, tobacco and tomato, from tobacco to tobacco [*cf.* **38** 149] and tomato, and from tomato to tomato, with an average efficiency of 50 per cent., *Macrosiphum* (*Myzus*) *solani* (Kalt.) transmitted it from chrysanthemum to chrysanthemum and tobacco, from tobacco to tobacco, and from

tomato to tomato, with an average efficiency of 75 per cent., *M.* (*Macrosiphoniella*) *sanborni* Gill. transmitted it from chrysanthemum to chrysanthemum and tobacco, with an average efficiency of 20 per cent., and *Rhopalosiphum rufomaculatum* (Wils.) transmitted it from chrysanthemum to chrysanthemum, with an average efficiency of 25 per cent. Failure to produce mosaic in cucumber and fleck in Creole Easter lily distinguishes tomato aspermy virus from cucumber mosaic virus.

Bart (G. J.) & Griswold (C. L.). **Recovery of viable Spores of *Endoconidiophora fagacearum* from Excrement of Insects used in Disease Transmission Studies.** (Abstract.)—*Phytopathology* **43** no. 9 p. 466. Baltimore, Md., 1953.

When adults of *Drosophila melanogaster* Mg. were allowed to feed on sporulating mats of *Endoconidiophora fagacearum*, the fungus that causes oak wilt [*cf. R.A.E.*, A **42** 303], their excreta were found to contain numerous endospores and a suspension of the excreta smeared on agar plates resulted in the development of typical colonies of the fungus. Spores from these colonies infected healthy oak seedlings.

Skotland (C. B.). **Aphid Transmission of the Wisconsin Pea Streak Virus.** (Abstract.)—*Phytopathology* **43** no. 9 p. 484. Baltimore, Md., 1953.

Macrosiphum pisum (Harris) (*Illinoia pisi* (Kalt.)) was shown in greenhouse experiments over three years to transmit the Wisconsin pea streak virus, although it did so in only 3 per cent. of tests. The Aphids acquired the virus by feeding for as little as 15 seconds, but more transmissions occurred when the feeding periods were one or five minutes. They transmitted it to healthy plants in feeding periods of five or more minutes, but infected only one plant of a series when transferred singly. In colony transfers, the virus persisted in the Aphids for three hours or longer. It was transmitted from red clover (*Trifolium pratense*), alsike clover (*T. hybridum*) and yellow sweet clover (*Melilotus officinalis*) to peas. It is proposed to classify the virus as non-persistent.

Slykhuis (J. T.). **The Relation of *Aceria tulipae* Keifer to Streak Mosaic and other chlorotic Symptoms on Wheat.** (Abstract.)—*Phytopathology* **43** no. 9 pp. 484–485. Baltimore, Md., 1953.

Aceria tulipae (Keifer) infesting diseased wheat [in South Dakota] transmitted wheat streak mosaic and induced other chlorotic symptoms and a leaf roll on young wheat plants [*cf. R.A.E.*, A **42** 169]. Cultures of mites that developed from eggs transferred to disease-free wheat caused a characteristic leaf roll but no chlorotic symptoms until the mites became extremely numerous. However, after these mites had fed on plants with symptoms of either streak mosaic or two types of a non-manually transmissible chlorosis, even small numbers of them induced the respective symptoms on disease-free wheat. All active stages of *A. tulipae* transmitted wheat streak mosaic. Although the virus persisted in the mites for several days, and was retained through moults, there was no indication that it passed to the eggs. Living mites and eggs were found on winter wheat collected at various times through the winter and spring, but the mites were quickly eliminated when infested plants were destroyed by cultivation. Wind dispersal of mites and hence of wheat streak mosaic was shown to occur.

Slykhuis (J. T.). **Striate Mosaic, a new Disease of Wheat in South Dakota.** —*Phytopathology* **43** no. 10 pp. 537–540, 3 figs., 13 refs. Baltimore, Md., 1953.

The following is based on the author's summary. A virus disease for which the name striate mosaic is proposed was found infecting winter and late spring wheat in South Dakota in 1950–51. The symptoms included fine chlorotic streaks along the leaf-veins. Of several species of Jassids collected in wheat fields, only *Endria* (*Polyamia*) *inimica* (Say) that had fed on infected wheat transmitted the virus to wheat seedlings. Both nymphs and adults proved to be vectors, and the shortest latent period of the virus in the adults was 10–14 days. Some individuals transmitted only once, and others many times. The plants infected included many varieties of wheat and also barley and oats.

Jensen (D. D.). **Leafhopper-Virus Relationships of Peach Yellow Leaf Roll.**—*Phytopathology* **43** no. 10 pp. 561–564, 5 refs. Baltimore, Md., 1953.

Colladonus geminatus (Van D.) was shown to transmit the virus that causes peach yellow leaf roll in California [*cf. R.A.E.*, A **40** 243], and factors affecting transmission were subsequently investigated. The following is based on the author's summary of the results. When tested individually in daily transfers to 809 peach trees, only two of 43 examples of *C. geminatus* that had fed for two days on infected peach transmitted the virus, one doing so to a single tree and the other to three. When a common source plant was used, one of 64 insects became infected in 24 hours, 17 of 61 in five days, and 9 of 65 in ten days. In successive transfers to healthy peach at daily or weekly intervals, infected Jassids retained the virus for up to 72 days, and up to 19 days elapsed between transmissions. The latent period in the vector ranged up to 64–71 days but was less than 45 days in most individuals, and the incubation period in greenhouse peach seedlings was 21–90 days, with a modal period of 31–40 days.

Stoner (W. N.). **Pierce's Disease Virus Infection, a Cause of Grape Degeneration in Florida.** (Abstract.)—*Phytopathology* **43** no. 5 p. 293. Baltimore, Md., 1953. **Leafhopper Transmission of a Degeneration of Grape in Florida and its Relation to Pierce's Disease.**—*T. c.* no. 11 pp. 611–615, 2 figs., 13 refs.

The second of these papers comprises a more detailed account of the investigations briefly described in the first, and the following is largely the author's summary of it.

Production of grapes in Florida has been impossible in the past because of a decline in vigour and death of the vines. Recent field observations and laboratory investigations indicated that this degeneration was possibly due to the virus of Pierce's disease [*cf. R.A.E.*, A **40** 60], since no visible pathogen had been consistently associated with the condition and the field ecologies of both were similar. Mechanical inoculations with sap from degenerate vines failed to infect test vines, but symptoms characteristic of Pierce's disease developed in healthy vines grafted with buds taken from degenerate vines. Trials with *Carneocephala flaviceps* (Ril.), which is abundant in affected vineyards, showed that healthy vines decline and die with symptoms identical with those of Pierce's disease, after being inoculated with insects previously fed on degenerate vines. Lucerne developed symptoms

of lucerne dwarf disease after being similarly inoculated. Field-collected *C. flaviceps* were also fed on test vines and lucerne plants. After a suitable incubation period, the plants developed symptoms similar to Pierce's disease and lucerne dwarf, respectively. Intertransmission tests with *C. flaviceps*, in which the insects were fed alternately on vines and lucerne after an infective feed on degenerate vines, showed that symptoms identical with those of Pierce's disease and lucerne dwarf can be produced alternately in the respective hosts after such feeding.

Freitag (J. H.) & Frazier (N. W.). **Natural Infectivity of Leafhopper Vectors of Pierce's Disease Virus of Grape in California.**—*Phytopathology* **44** no. 1 pp. 7–11, 3 refs. Baltimore, Md., 1954.

The following is based on the authors' summary. Tests were conducted to determine the percentage of the Jassid vectors of the virus of Pierce's disease of grape vines that were carrying the virus under natural conditions in habitats of five types in California, particular emphasis being placed on the three economically important vectors, *Draeculacephala minerva* Ball, *Carneocephala fulgida* Nott. and *Hordnia circellata* (Baker). Collections of *D. minerva* and *C. fulgida* indicated that infected examples of both species occurred in vineyards, irrigated pastures, lucerne fields, roadsides and ditches, and natural breeding areas (uncultivated range, meadows, pastures, bogs and river-banks). *D. minerva* was the most highly infected in lucerne fields, and *C. fulgida* in irrigated pastures. The nymphs of *D. minerva* showed a lower percentage of infection than the adults. *D. minerva* and *C. fulgida* were found naturally infected during every month of the year except February, when only a few tests were conducted, maximum infectivity being observed in lucerne fields during October. The trend of natural infection during the year in habitats of the five types tested indicated a peak in March, a fall during the summer, and an increase in the autumn, reaching its highest peak during October. *H. circellata* reached its highest degree of natural infectivity during the autumn in vineyards, natural breeding areas, and ornamental gardens. The percentages of individuals found to be infective in a given area were 18·6 per cent. for *D. minerva*, 18·7 for *C. fulgida* and 11 for *H. circellata*.

Helochara delta Oman was found naturally infected with the virus when collected in an area remote from cultivated grapes and lucerne at an elevation of 7,000 ft. in the Sierra Nevada Mountains.

These results suggest that the virus occurs naturally wherever the three important vectors are found. Of 15 species of Jassids known to transmit it, 11 were found to be infected under natural conditions. Naturally infected Jassids occur in widely different habitats in California, and only three localities were found in a limited number of tests in which there were no infective individuals.

Maramorosch (K.). **A Leafhopper-borne Disease from Western Europe.** (Abstract.)—*Phytopathology* **44** no. 2 p. 111. Baltimore, Md., 1954.

A briefer account than one already noticed is given of investigations in Holland in which examples of *Euscelis plebeja plebeja* (Fall.) collected from grass in an orchard of cherry trees infected with the virus of Eckelrade disease transmitted an unknown virus to crimson clover (*Trifolium incarnatum*) [*R.A.E.*, A **43** 82]. It is not known whether there is any relation between the two viruses.

GIDDINGS (N. J.). **Two recently isolated Strains of Curly Top Virus.**—*Phytopathology* **44** no. 3 pp. 123–125, 1 fig., 7 refs. Baltimore, Md., 1954.

The following is largely the author's summary. An extremely virulent strain of the curly top virus, designated strain 11, was discovered in 1947 in sugar beet and in field collections of the beet leafhopper, *Circulifer tenellus* (Baker) in southern Idaho. It also occurred in southern California. It induced severe symptoms in some varieties of beet that had been considered highly resistant and proved very destructive to tomatos.

A strain, designated strain 12, that readily infected potatoes was obtained from potatoes and tomatos in eastern Washington in 1950 and from potatoes in southern California in 1952. It was also highly virulent in tomato, but the virus concentration in potatoes was rather low.

MACCARTHY (H. R.). **Aphid Transmission of Potato Leafroll Virus.**—*Phytopathology* **44** no. 4 pp. 167–174, 2 figs., 17 refs. Baltimore, Md., 1954.

The following is taken from the author's summary of the greenhouse investigations described. Non-infective apterous adults of *Myzus persicae* (Sulz.), allowed to feed singly for a minimum of five days on newly-emerged potato plants infected with leaf-roll, transmitted the virus to about 70 per cent. of *Physalis floridana* seedling indicator plants; 83 per cent. of the Aphids transmitted the disease. Alates that fed for five days or longer on infected potato were found capable of transmitting the virus for as long as they lived. A period on an immune host of up to 24 days, between the acquisition and inoculation feedings, did not destroy the virus within the insect. Distribution of infections chronologically by apterous and alate Aphids transferred to a fresh indicator plant daily was almost completely random, most of the Aphids remaining infective until they died of old age. The acquisition threshold period was found to be two hours, and the inoculation threshold period 30 minutes. The transmission threshold period was 12 hours, comprising four-hour acquisition and eight-hour inoculation feedings.

No infections were produced in 83 *P. floridana* seedling indicators individually infested by 40 apterous adults of *Macrosiphum solanifolii* (Ashm.), two in 170 *P. floridana* indicators infested by 180 apterous adults of *M.* (*Myzus*) *solani* (Kalt.), which produced toxic symptoms in the plants, and 41 in 176 *P. floridana* indicators infested by 26 apterous adults of *Myzus ornatus* Laing. *Aphis gossypii* Glov. proved incapable of transmitting the virus.

ANDERSON (C. W.). **Two Watermelon Mosaic Virus Strains from central Florida.**—*Phytopathology* **44** no. 4 pp. 198–202, 1 fig., 24 refs. Baltimore, Md., 1954.

Two strains of a virus, designated *Marmor citrulli* and *M. citrulli* var. *flavidanum*, respectively, were isolated from *Cucurbita pepo melopepo* (yellow summer crook-neck squash) in Florida in 1950–51. In tests, both strains infected cucurbits of 12 species, and var. *flavidanum* (yellow strain) one other. Neither infected *Momordica charantia*, tobacco, *Capsicum frutescens*, or *Zinnia elegans*. Both strains were transmitted by *Myzus persicae* (Sulz.). The characteristics of the two strains and the symptoms caused are described.

Nielson (M. W.) & Jones (L. S.). **Insect Transmission of Western-X-Little-Cherry Virus.**—*Phytopathology* **44** no. 4 pp. 218–219, 1 fig., 4 refs. Baltimore, Md., 1954.

The results are given of tests in Oregon in 1951 in which the virus that causes the disease known as western-X-little-cherry was transmitted from sweet and sour cherry to Montmorency cherry by *Colladonus geminatus* (Van D.) [*cf. R.A.E.*, A **42** 299]. The Jassids fed for 37–46 days on infected trees and for 116–126 days in batches of over 25 on healthy test trees, and symptoms appeared on 35 per cent. of the latter about a year later. It was not transmitted in similar tests to cherry or peach from infected peach, in which it causes western-X-disease [*cf. loc. cit.*].

Sylvester (E. S.). **Yellow-net Virus Disease of Tomato.**—*Phytopathology* **44** no. 4 pp. 219–220, 1 fig., 2 refs. Baltimore, Md., 1954.

Since 1946, a virus disease termed yellow net, the symptoms of which are described, has occurred sporadically on tomato in California. In tests, the virus was transmitted by *Myzus persicae* (Sulz.) to about 17 per cent. of the test plants. The Aphids were allowed to feed in batches of ten, and the transmission cycle was completed in 72 hours. The insects remained infective for several days. Although the symptoms and the vector relations resemble those of beet yellow-net virus, no infection was obtained in tests in which infective Aphids from tomato and beet were transferred to beet and tomato, respectively.

Boosalis (M. G.). **Hessian Fly in Relation to the Development of Crown and Basal Stem Rot of Wheat.**—*Phytopathology* **44** no. 5 pp. 224–229, 2 figs., 5 refs. Baltimore, Md., 1954.

The following is based on the author's summary. *Mayetiola* (*Phytophaga*) *destructor* (Say) has recently become an increasingly important factor in the production of wheat in several areas of Nebraska, and investigations in 1951–53 showed that the injury caused by the feeding larvae renders the affected tissues vulnerable to attack by soil micro-organisms that cause crown rot. The predominant organisms found associated with damage by *M. destructor* were saprophytic fungi of the genera *Helminthosporium* and *Fusarium* and non-pathogenic bacteria. Although healthy and deteriorated crown tissue had a similar microflora, a substantially higher percentage of the diseased tissues yielded isolates of fungi and bacteria. Symptoms on plants infested by *M. destructor* and showing crown rot differed only in degree of severity from those on plants infected by the insect only. Stunting, delay of maturation and grain injury were more pronounced on infected wheat showing deteriorated crowns. The syndrome of infested plants showing crown rot was similar to that of plants damaged solely by parasitic fungi.

Simons (J. N.). **Vector-Virus Relationships of Pea-enation Mosaic and the Pea Aphid** *Macrosiphum pisi* **(Kalt.).**—*Phytopathology* **44** no. 6 pp. 283–289, 3 graphs, 18 refs. Baltimore, Md., 1954.

In greenhouse tests in California, the virus of pea enation mosaic was transmitted from infected to healthy bur clover (*Medicago hispida*) by *Macrosiphum pisum* (Harris) (*pisi* (Kalt.)), *M. solanifolii* (Ashm.) and *Myzus*

persicae (Sulz.) [*cf. R.A.E.*, A **39** 46] and also by *M. ornatus* Laing, and from bur clover to pea, sweet pea (*Lathyrus odoratus*), soy bean and crimson clover (*Trifolium incarnatum*) by *Macrosiphum pisum*; spotted medick (*Medicago arabica*) was found to be naturally infected.

In studies on transmission by adults of *Macrosiphum pisum*, using bur clover, the Aphids acquired the virus in threshold feeding periods of 1–2 hours and transmitted it in threshold feeding periods of 15–20 minutes. The effect of length of acquisition feeding on infection was almost linear, and that of transmission feeding logarithmic. Retention of the virus was positively correlated with the length of the acquisition feeding period, and starving newly infected Aphids for 24 hours had no effect on transmission. First-instar nymphs of *M. pisum* were more efficient vectors than the adults, the mean latent periods of the virus in them being 30 and 56·8 hours, respectively.

Webb (R. E.) & Larson (R. H.). **Mechanical and Aphid Transmission of the Feathery Mottle Virus of Sweet Potato.**—*Phytopathology* **44** no. 6 pp. 290–291, 1 fig., 1 ref. Baltimore, Md., 1954.

A virus disease of sweet potato resembling that caused by the feathery mottle virus was found in central Wisconsin in 1951 and in two areas in Louisiana in 1952. It was transmitted to sweet potato by mechanical means, and in tests, the feathery mottle virus also proved mechanically transmissible. The latter was transmitted from infected to healthy sweet potato by *Myzus persicae* (Sulz.), and it was found to be translocated to the fleshy roots from which sprouts are taken for planting, so that new plants were infected. Cross-protection tests indicated a close relation between feathery mottle and the virus from Wisconsin and Louisiana.

Rich (S.). **Miticidal Action of Barium and Manganese Ethylene Bisdithiocarbamates.**—*Phytopathology* **44** no. 7 p. 387, 5 refs. Baltimore, Md., 1954.

When a wettable powder containing barium ethylenebisdithiocarbamate was applied at 0·5 and 2 lb. per 100 U.S. gals. six times between 9th April and 16th June 1953, by the half-tree technique, to apple in Connecticut against apple scab [*Venturia inaequalis*], with a separate application of DDT at 2 lb. per 100 U.S. gals. on 20th May, the fungus was well controlled by 2nd July, with no spray injury to the foliage, and *Paratetranychus pilosus* (C. & F.), which became numerous on unsprayed foliage, was absent from that receiving the fungicide at the higher concentration.

In greenhouse tests of the acaricidal properties of this and other organic fungicides, the barium-ethylenebisdithiocarbamate wettable powder, the same compound freshly prepared, and proprietary preparations of manganese ethylenebisdithiocarbamate (Manzate), 2-heptadecyl-2-imidazoline (Crag 341-C) and 2,4-dinitro-6-caprylphenylcrotonate (Iscothan) diluted 1:400 gave complete kill of nymphs and adults of *Tetranychus bimaculatus* Harvey on bean plants, and the last was highly toxic to the eggs. The two ethylenebisdithiocarbamates required the addition of a wetting agent for acaricidal effectiveness. Nabam [disodium ethylenebisdithiocarbamate], barium chloride and zineb [zinc ethylenebisdithiocarbamate] were completely ineffective, though the first has been reported to be toxic to *T. bimaculatus* on strawberries and carnations at a lower concentration.

Dickson (R. C.), Johnson (M. McD.) & Laird (E. F.). **Leaf Crumple, a Virus Disease of Cotton.**—*Phytopathology* **44** no. 8 pp. 479–480, 1 fig., 3 refs. Baltimore, Md., 1954.

The cotton grown in the Coachella and Imperial Valleys of south-eastern California belongs to the Acala variety of *Gossypium hirsutum* and is affected by a virus disease termed leaf crumple. This disease becomes increasingly common during the summer in sown crops, and ratoon cotton often shows 100 per cent. infection by midsummer. The virus causes leaf symptoms, which are described, but does not stunt the plants conspicuously or prevent the setting of bolls, and it is not evident whether it reduces yield. It is apparently distinct from other cotton viruses, including that causing leaf-curl in Africa [*cf. R.A.E.*, A **40** 319]. In tests, it was transmitted by grafting, but not by sap inoculation, and also by Aleurodids. Two species of the latter occur on cotton in the area concerned, *Trialeurodes abutilonea* (Hald.) and *Bemisia inconspicua* (Quaint.). The former is usually dominant in outbreaks, but the latter is equally widespread and is sometimes the more numerous. Neither has been observed in the absence of the other. Batches of adults collected from severely infected cotton, in which *B. inconspicua* predominated, transmitted the virus to 16·7 per cent. of healthy cotton plants, and batches in which *T. abutilonea* predominated transmitted it to 37·1 per cent. Attempts to infect plants other than cotton proved unsuccessful.

Davidson (R. W.). **Species of Ophiostomataceae associated with Engelmann Spruce Bark Beetle.** (Abstract.)—*Phytopathology* **44** no. 9 p. 485. Baltimore, Md., 1954.

A survey in Colorado showed that four species of wood-staining fungi were associated with *Dendroctonus engelmanni* Hopk. on *Picea engelmanni*. These are *Leptographium* sp., the most conspicuous and constant associate of the bark-beetle, which causes a grey stain in the sapwood, *Endoconidiophora coerulescens*, which is sometimes present in the insect galleries, and two species of *Ophiostoma*, which were isolated from the galleries or from the adult beetles. The significance of the fungi for *Dendroctonus* is not known.

Jensen (D. D.). **The Effect of Aphid Toxins on *Cymbidium* Orchid Flowers.** (Abstract.)—*Phytopathology* **44** no. 9 pp. 493–494. Baltimore, Md., 1954.

Aphids feed reluctantly on the leaves of orchids of the genus *Cymbidium*, but natural infestations frequently occur on the buds. *Myzus circumflexus* (Buckt.) feeds on the under sides of the younger buds, causing dwarfing and distortion of the sepals, *Macrosiphum* (*Myzus*) *solani* (Kalt.) causes discoloration of the sepals and bud-fall, and *Myzus ornatus* Laing and *M. persicae* (Sulz.) cause chlorotic spots that sometimes persist after the flowers open.

Jensen (D. D.) & Thomas (H. E.). **Leafhopper Transmission of the Napa Strain of Cherry Buckskin Virus from Cherry to Peach.** (Abstract.)—*Phytopathology* **44** no. 9 p. 494. Baltimore, Md., 1954.

In tests, *Colladonus geminatus* (Van D.) transmitted the Napa (California) strain of the cherry buckskin virus from cherry to 42 of 281 healthy peach seedlings. The Jassids were allowed to feed for 37 days on the infected cherry trees and were transferred weekly in groups of 20 to successive peach

seedlings. All were dead by September 1953. The first transmission occurred 51–57 days after the insects were caged on the infected source. Symptoms appeared on 33 of the seedlings in the autumn of 1953 and on the other nine in the spring of 1954.

Raymer (W. B.) & Amen (C. R.). **An Association of Late-breaking Virus in Potato with a Phyllody Condition in Ladino Clover.** (Abstract.)—*Phytopathology* **44** no. 9 p. 503. Baltimore, Md., 1954.

An unusual virus disease of potato, termed late-breaking disease, appeared in central Oregon in 1946 and became common in 1950, with the increased cultivation of ladino clover [*Trifolium repens latum*]. In 1953, the percentage infection averaged 12 and ranged up to 36 in individual fields. Adjacent ladino clover showed phyllody, and this and a proliferation of lateral buds were observed on species of *Lactuca*, *Brassica*, and *Erigeron* growing as weeds. Examples of the aster leafhopper [*Macrosteles fascifrons* (Stål) (*cf. R.A.E.*, A **41** 322)] from these fields were fed on China aster [*Callistephus*], celery, lettuce and potatoes, and symptoms of aster yellows developed on all but the potatoes, which showed symptoms of late-breaking. It is concluded that the late-breaking virus is a strain of the aster-yellows virus complex. The field spread of the disease is correlated with movement of the leafhoppers to the emerging potatoes when ladino clover is clipped in the spring.

Slykhuis (J. T.). **Hosts in Relation to the Incidence of Wheat Streak Mosaic in Alberta.** (Abstract.)—*Phytopathology* **44** no. 9 p. 506. Baltimore, Md., 1954.

In tests in Alberta, *Aceria tulipae* (Keifer) transmitted the virus of wheat streak mosaic (*Marmor virgatum* of McKinney) [*cf. R.A.E.*, A **43** 270] to ten species of wild and 12 species of cultivated annual grasses. Sparse populations of the mite survived on barley, rye and several wild annual and perennial grasses, all of which can be infected with the virus. Mites from several wild grasses failed to survive on wheat, and those from wheat failed on the grasses. Wheat was the only plant tested that was highly susceptible to the virus and readily colonised by *A. tulipae* from diseased wheat. The virus and its vector overwinter on winter wheat, and immature wheat plants harbour them during spring, summer and autumn, supplying a source of infection for wheat sown in the same or neighbouring fields. No native grasses proved important sources of the virus in Alberta.

Slykhuis (J. T.) & Horricks (J. S.). **Problems encountered when Spring Wheat is seeded after working up Streak Mosaic diseased Winter Wheat.** (Abstract.)—*Phytopathology* **44** no. 9 p. 506. Baltimore, Md., 1954.

Winter wheat in Alberta is sometimes so severely infected with wheat streak mosaic [*cf.* preceding abstract] that it is advisable to plough it under and sow spring wheat. The latter may also become infected if the remains of the winter crop are not sufficiently desiccated or decomposed to kill the vector, *Aceria tulipae* (Keifer), or if destruction of the winter crop is not complete. In general, a delay of one week after a thorough cultivation is considered sufficient.

Sylvester (E. S.). **Transmission of Lettuce Mosaic Virus by the Green Peach Aphid.** (Abstract.)—*Phytopathology* **44** no. 9 p. 507. Baltimore, Md., 1954.

Myzus persicae (Sulz.) transmitted the virus of lettuce mosaic [*cf. R.A.E.*, A **27** 671] to lettuce seedlings after acquisition threshold periods of 10–15 seconds, transmission increasing in efficiency with feeding periods of up to 30 seconds, and inoculation threshold periods of 5–10 seconds, with no increase in efficiency with feeding periods of up to 30 seconds. Pre-acquisition fasting periods as short as five minutes increased the probability of obtaining infective insects, and vector efficiency decreased when infective Aphids fed for prolonged periods on either a source plant or a virus-free plant. Loss of virus also occurred when infective Aphids were kept without food. The most rapid loss of efficiency occurred when the insects fed on a virus-free plant after acquisition of the virus, and less rapid loss when infective Aphids remained for long periods on a virus source plant. Maximum retention occurred when infective Aphids were kept without food before feeding on a healthy test plant.

Teitelbaum (S. S.) & Black (L. M.). **The Effect of a phytophagous Species of *Tetrastichus*, new to the United States, on Sweet Clover infected with Wound-tumor Virus.**—*Phytopathology* **44** no. 9 pp. 548–550, 5 figs., 5 refs. Baltimore, Md., 1954.

Sweet clover (*Melilotus alba* and *M. officinalis*) growing in a greenhouse at the Brooklyn Botanic Garden was found to show small holes along the older parts of the stems and branches and slight swellings on the younger portions near the tips. When the swollen parts were cut open, cavities in the pith were found containing larvae, pupae and a few adult insects, and adults that emerged from caged plants were identified as a species of *Tetrastichus* near *T. venustus* Gah. All were females, indicating that reproduction is parthenogenetic. No other phytophagous species of *Tetrastichus* is known in North America, and no other plants in the greenhouse were attacked. Different clones of sweet clover were attacked to different degrees, and, on plants infected with the wound-tumour virus [*cf. R.A.E.*, A **43** 269], the development of tumours was correlated with emergence holes of the Eulophid. When adults were liberated on sweet clover, they mostly remained near the young growing tips, and these later developed small swellings. The adults did not feed, were resistant to dry conditions, and survived for about four days in a test tube without food or water, several living for as long as a week.

Skotland (C. B.) & Hagedorn (D. J.). **Aphid Transmission of the Wisconsin Pea Streak Virus.**—*Phytopathology* **44** no. 10 pp. 569–571, 7 refs. Baltimore, Md., 1954.

A more detailed account than one already noticed [*R.A.E.*, A **43** 270] is given of experiments in Wisconsin on the transmission of the Wisconsin pea streak virus by *Macrosiphum pisum* (Harris) (*pisi* (Kalt.)). It is further stated that the virus was transmitted from peas to broad beans (*Vicia faba*), and that the efficiency of transmission was slightly increased by a period of starvation before the Aphids acquired the virus, but not by increasing the acquisition feeding periods from one to 24 hours or varying the age of the Aphids. Increased transmission resulted from feeding on source plants showing late symptoms of the disease.

Shaw (M. W.). **Preliminary Studies on Potato Aphids in North and North-east Scotland.**—*Ann. appl. Biol.* **43** no. 1 pp. 37–50, 6 figs., 12 refs. London, 1955.

The following is substantially the author's summary. Studies of potato Aphids were made in the potato seed-growing areas of north and north-east Scotland during 1950–53. The species found were the four common potato Aphids, *Myzus persicae* (Sulz.), *Macrosiphum solanifolii* (Ashm.) (*euphorbiae*, auct.), *M.* (*Aulacorthum*) *solani* (Kalt.) and *Aphis nasturtii* Kalt. [the species previously misidentified as *A. rhamni* Boy.]. Potato plants were first infested during July, but with few Aphids; maximum populations did not develop until mid–late August or early September, which is the period of potato haulm destruction in seed crops. *Myzus persicae* was scarce in rural districts and most numerous near urban areas. The main influx of alatae occurred in early August. *Macrosiphum solani* was the predominant species north of Inverness. *M. solanifolii* was present in small numbers in many potato fields, but *A. nasturtii* was extremely scarce. Because of the small numbers of Aphids found during two years by examining two or three compound leaves per haulm, it was preferable to count the Aphids on one main stem and all its leaves. Stove-pipe sticky traps provided information complementary to complete stem/leaf examination, but are considered to be of doubtful use in an area where Aphids are few.

Johnson (C. G.) & Taylor (L. R.). **The Development of large Suction Traps for airborne Insects.**—*Ann. appl. Biol.* **43** no. 1 pp. 51–62, 2 pls., 1 fig., 9 refs. London, 1955.

The following is the authors' summary. Small suction traps for estimating the density of airborne insects, and its fluctuations, in relatively sheltered situations, *e.g.*, in crops, have already been designed and used [*R.A.E.*, A **40** 39]. Larger, more powerful traps have now been developed for use in more exposed situations where insect densities are very low, or where winds are relatively strong, *e.g.*, high in the air. Because of the large sample obtained they also enable very short-term density fluctuations to be followed. The radical modifications of design and the special problems encountered in the operation of very large traps are described.

Jones (F. G. W.), Dunning (R. A.) & Humphries (K. P.). **The Effects of Defoliation and Loss of Stand upon Yield of Sugar Beet.**—*Ann. appl. Biol.* **43** no. 1 pp. 63–70, 2 figs., 5 refs. London, 1955.

The following is based on the authors' introduction and summary. Sugar-beet seedlings in Britain are attacked by wireworms (*Agriotes* spp.) and millepedes (*Blaniulus guttulatus* (Bosc.)), which feed below ground and cause only loss of stand, by *Pegomyia hyoscyami* var. *betae* (Curt.), which mines in the leaves, causing a form of defoliation but no loss of stand, and by various insects including *Atomaria linearis* Steph., *Euxoa nigricans* (L.), *Agrotis segetum* (Schiff.), *Tipula* spp., *Chaetocnema concinna* (Marsham) and *Silpha* (*Aclypea*) *opaca* L., which cause defoliation and loss of stand due to severance of the hypocotyl.

Attempts were made to assess the effects of these types of injury by means of field trials in which the defoliation and loss of stand were produced artificially shortly after singling. The main effects of these treatments were to modify the size of the plants without greatly influencing their percentage sugar content. Little loss of crop resulted until 50 per cent. of the leaf area or 50 per cent. of the plant population had been destroyed.

The yield from resowing after removal of all the plants was inferior to that from stands depleted of half or two-thirds of their initial plant population. The relation between the results of artificial injury and of the injury produced by the pests is briefly discussed.

Hollings (M.). **Investigation of Chrysanthemum Viruses. I. Aspermy Flower Distortion.**—*Ann. appl. Biol.* **43** no. 1 pp. 86–102, 1 pl., 23 refs. London, 1955.

A distortion of chrysanthemum flowers is common in England and causes losses to commercial growers. Investigations of several hundred plants with flower and leaf abnormalities showed that many of them were infected with the tomato aspermy virus [*cf. R.A.E.*, A **38** 148], and the behaviour and properties of the latter were therefore studied. The following is based partly on the author's summary of the results.

Tomato aspermy virus alone distorted some chrysanthemum flowers, and it aggravated the symptoms caused by other chrysanthemum viruses. First-season infection affected only a proportion of the blooms, but nearly all the flowers showed symptoms with increased severity in subsequent seasons. Three strains were isolated. The virus had a wide host range, extending to several families of plants, and it was transmitted to a negligible extent by cultural operations and not at all through seeds or soil. In tests with Aphids [*cf.* **38** 149; **43** 269], it was transmitted from chrysanthemum to chrysanthemum by *Myzus persicae* (Sulz.), *Macrosiphum solanifolii* (Ashm.) (*euphorbiae*, auct.), *M.* (*Aulacorthum*) *solani* (Kalt.), *M.* (*Macrosiphoniella*) *sanborni* Gill., and *Anuraphis padi* (L.) (*Brachycaudus helichrysi* (Kalt.)) but not by *Myzus ascalonicus* Doncaster or *Rhopalosiphum* (*Coloradoa*) *rufomaculatum* (Wils.), from tobacco to tobacco by the first four of these but not by *M. ascalonicus* or *Aphis nasturtii* Kalt. (*rhamni*, auct.), and from aster (*Callistephus chinenis*) to aster by *Anuraphis padi*. The Aphids were tested in batches of 5–10 per plant, and they were allowed to feed for 2–5 minutes on the virus source and for 30 minutes on the healthy plants. Except for *Aphis nasturtii*, all these Aphids commonly infest chrysanthemums, especially under glass. Infective examples of *M. persicae* and *Macrosiphum solanifolii* lost their infectivity, usually within 30 minutes and always within an hour, when allowed to feed, but remained infective for up to 75 minutes when prevented from doing so.

The physical properties of the virus were similar to those of other non-persistent viruses of the mosaic type. There was no cross-protection in tests with aspermy virus, cucumber mosaic (three strains), which it resembles, and five other viruses, and comparison of aspermy virus with four strains of cucumber mosaic showed that it differed more from the latter than they did among themselves.

The control methods suggested comprise thorough rogueing of chrysanthemum stocks at flowering time, care in selecting new material for propagation, and control of Aphids, in particular early in the season.

Kassanis (B.). **Some Properties of four Viruses isolated from Carnation Plants.**—*Ann. appl. Biol.* **43** no. 1 pp. 103–113, 1 pl., 18 refs. London, 1955.

Stocks of most of the popular varieties of carnation grown in England are probably infected with viruses. Many plants examined showed definite leaf and flower symptoms, but even those that did not were readily shown to be infected by inoculating sap from them into Sweet William (*Dianthus*

barbatus). Three viruses were identified from carnation that produced symptoms in Sweet William seedlings, and one that caused no symptoms in either plant. The properties of all four were studied, mainly in Sweet William seedlings and the results are presented in detail. Two of the first three were not transmitted by *Myzus persicae* (Sulz.), but the other two viruses, termed carnation vein mottle and carnation latent virus, respectively, were readily transmitted by Aphids that were starved for 3–4 hours, fed on infected leaves for 2–5 minutes and were transferred overnight to healthy plants. The latent virus was also transmitted by *M. persicae* to sugar beet, in which it sometimes caused a yellowing of the older leaves. Since the Aphid is common on carnations under glass, its control may reduce the spread of these two.

Collingwood (C. A.). **The Glasshouse Red Spider Mite on Blackcurrants.** —*Ann. appl. Biol.* **43** no. 1 pp. 144–147, 1 graph, 4 refs. London, 1955.

Tetranychus telarius (L.) (*urticae* Koch) has become a troublesome and persistent pest of black currants in the west midlands of England since DDT was used for the control of insects attacking the plants. The economic damage is difficult to assess, and some control is given by low winter temperatures and by predators. Four or five main generations a year were observed in the field, but individual mites live for up to a month and considerable overlap may occur. In tests on control, contact poisons failed to give permanently satisfactory results, owing to the difficulty of wetting the lower surfaces of the black-currant leaves, but a spray of the systemic toxicant schradan proved very promising, one application in the period of active growth between mid-May and early June giving almost complete control for ten weeks and two giving protection for the whole season. Chlorparacide [p-chlorobenzyl p-chlorophenyl sulphide] and PCBS [p-chlorophenyl p-chlorobenzenesulphonate], which showed no phytotoxicity, were the best of several ovicides tested.

Taylor (C. E.). **Growth of the Potato Plant and Aphid Colonization.**— *Ann. appl. Biol.* **43** no. 1 pp. 151–156, 1 graph, 3 refs. London, 1955.

At the time of the primary migration of potato Aphids from their winter food-plants in Britain, the potato plants are usually well above ground, though small. Most of the spring migrants appear near the growing points, and it has been assumed that nymphs are also mostly deposited there. In 1952, there was a particularly large spring migration of *Aphis nasturtii* Kalt., which, as the author points out, has in the past been misidentified as *A. rhamni* Boy. The alates showed a fairly even distribution on the plants, but the nymphs were most numerous and the ratio of nymphs to adults highest on the lowermost leaves. Alates of *Myzus persicae* (Sulz.) are rarely observed on the plants during the period of primary migration, but most of the first-instar nymphs were found on the lower leaves and had probably been deposited there. Various factors may induce the Aphids to congregate on the lower leaves in spring, but an examination of the progression of the infestation indicated that feeding preferences are involved, particularly in the case of *M. persicae*, the infestation invariably beginning on the lower leaves of the main stem and spreading upwards to the middle leaves as these become senescent and outwards to the axillary shoots. The way in which this affects the infestation of varieties of potato with leaves that pass from the young to the senescent stage at different rates and of a single variety planted on different dates is illustrated from field observations.

Gómez Clemente (F.). **Los insectos auxiliares en la lucha contra los nocivos a los agrios. Algunos estudios realizados en la Estación de Fitopatología Agrícola de Burjasot (Valencia).** [Auxiliary Insects in the Control of *Citrus* Pests. Studies carried out at the Agricultural Phytopathology Station, Burjasot (Valencia).]—*Bol. Pat. veg. Ent. agric.* **19** (1951–52) pp. 1–18, 8 figs., 22 refs. Madrid [1954]. **Estado actual de la lucha biológica contra algunas cochinillas de los agrios (*Pseudococcus citri*) y *Pericerya purchasi*).** [The present Situation in the Biological Control of some *Citrus* Scales (*Planococcus citri* and *Icerya purchasi*).]—*T. c.* pp. 19–35, 13 figs.

The first of these papers comprises a review from the literature of work during the past 50 years on the biological control of *Citrus* pests in Spain, including the introduction of various parasites and predators.

In the second paper, it is stated that *Rodolia cardinalis* (Muls.) has become acclimatised on the Mediterranean coast of Spain and in the temperate regions inland and affords effective control of *Icerya* (*Pericerya*) *purchasi* Mask., which is no longer a serious pest of *Citrus* there. It is still reared in the laboratory, however, to provide colonies for liberation early in the season, since reproduction of the Coccid begins under natural conditions earlier than that of the predator. The numbers reared in 1926–50 and distributed to various parts of Spain and to certain other countries are shown in tables.

Cryptolaemus montrouzieri Muls. is in course of establishment in Valencia, where it attacks *Planococcus* (*Pseudococcus*) *citri* (Risso) and *Pulvinaria floccifera* (Westw.) on orange but suffers heavy mortality from the treatments applied against other Coccids. It is reared on *Planococcus citri* on potato sprouts, and tables are given showing the numbers produced in 1928–50 and the parts of Spain and other countries to which they were sent. In investigations on the production of strong potato sprouts capable of supporting the complete development of *Planococcus*, tubers planted in boxes within two months of digging and kept in the dark produced only tender sprouts that soon died when infested, but those planted 90–100 days or more after digging proved satisfactory. Details of the cycles of production in 1951 from the planting of the tubers to the emergence of the *Cryptolaemus* adults are shown in a table. The permanent establishment of *C. montrouzieri* in the groves is hindered not only by treatments applied against other Coccids, but also by the fact that *P. citri* is not easily accessible to it from November to May, and that it is attacked by ants. However, hedges that act as dust and wind barriers round the groves have proved of value as refuges. The best results were obtained by liberating 20 adults on each tree in a grove, even though the mealybug was not present on all the trees. Where ants are abundant, they should be destroyed before liberations are made.

Gómez Clemente (F.) & Planes García (S.). **Algunas notas sobre la ecología de *Ceratitis capitata* en el Levante español sobre naranjos.** [Notes on the Ecology of *C. capitata* on Oranges in eastern Spain.]—*Bol. Pat. veg. Ent. agric.* **19** (1951–52) pp. 37–48, 7 graphs. Madrid [1954].

Oranges of early varieties grown near Valencia are liable to attack by *Ceratitis capitata* (Wied.) in October–November, when they are beginning to change colour, though mortality of the immature stages in them is heavy. The severity of the attack depends largely on temperature and humidity, and the fall in the former in November usually checks its development. The monthly averages of temperature and humidity from January 1947 to December 1951 are given in a table together with graphs showing the

numbers of adults of *C. capitata* taken in traps from September to February in 1947–51 and the average daily temperatures and rainfall for that period, and others relating the monthly conditions to those optimum for development. In 1950, the first adults appeared in the orange groves on 14th September, as compared with dates ranging from 1st October to 1st November in other years, and the population reached a high peak in mid-November. The temperature rose at the end of November, but as the average for the month was below the optimum for development and oviposition, injury was slight. The most favourable conditions for development occurred in 1947 and 1949, and the least favourable in 1951, when the optimum was not reached.

Gómez Clemente (F.), Planes García (S.) & del Rivero (J. M.). **Lucha química contra la oruga de las cápsulas del algodonero** (*Earias insulana*) **(cuatro años de experiencias).** [The chemical Control of *E. insulana*. (Four Years of Experiments.)]—*Bol. Pat. veg. Ent. agric.* **19** (1951–52) pp. 59–85, 4 graphs, 12 refs. Madrid [1954].

The results are given in detail of experiments in 1948–51 on the control of *Earias insulana* (Boisd.) on cotton in Spain, those obtained in the first two years having already been noticed [*R.A.E.*, A **41** 50].

In the laboratory experiments in 1949–50, sprayed bolls were allowed to dry, and dusted ones were tapped free from excess dust before the larvae were placed on them. In 1950, the mortality percentages were 100 in 24 hours for a spray of 0·15 per cent. parathion and 93 for 0·5 per cent. lindane [almost pure γ BHC], 90 for a mixture of 1·5 per cent. cryolite, 0·5 per cent. fish oil and 0·2 per cent. blood albumin, and 87 and 83 for 0·4 per cent. dieldrin and aldrin, respectively, all in 72 hours, other sprays proving less effective. Of the dusts tested, cryolite alone or mixed 3:1 with talc gave 90–97 per cent. mortality, and a 1:1 mixture of sodium fluosilicate and magnesium carbonate gave 93 per cent. mortality, both in 72 hours. In 1951, the sprays that gave the best results were 0·5 and 0·15 per cent. parathion (81 and 95 per cent. mortality in 48 hours, respectively) and 0·25 per cent. dieldrin and 0·5 per cent. H-24 (a terpene preparation of unspecified composition) (complete mortality in 96 hours). Of the numerous dusts tested, the best results were given by sodium fluosilicate (complete mortality in 48 hours), mixtures of 0·2 per cent. lindane with 66·6 or 50 per cent. cryolite (97 per cent. mortality in 48 and 72 hours, respectively), a mixture of 50 per cent. sodium fluosilicate and 5 per cent. BHC (93 per cent. mortality in 48 hours), and 0·8 per cent. parathion (90 per cent. mortality in 72 hours). When larvae were confined with bolls and leaves sprayed four days previously, the mortality percentages after a further 72 hours were 60 for 0·25 per cent. dieldrin, 70 for 0·15 per cent. parathion, 10 for 0·3 per cent. lindane and 20 for 0·4 per cent. H-24.

In field experiments in 1950, the average percentage of bolls attacked was reduced in carefully treated areas from 37·84 for no treatment to 7·93, 10 and 8·12 by dusts of 50 per cent. sodium fluosilicate, barium fluosilicate and cryolite in talc, respectively, applied at intervals of 15 days, and to 7·5 and 9·74 by sprays of 1 per cent. BHC with 1 per cent. barium fluosilicate or 0·7 per cent. sodium fluosilicate, respectively, applied at ten-day intervals. Sprays of DDT with either fluosilicate or with cryolite or of BHC with cryolite were less effective. In 1951, the percentage was reduced from 34·17 to 4·34–5·81 by dusts of 75 per cent. sodium fluosilicate (in talc), or barium fluosilicate (in barium sulphate) and 75 and 50 per cent. cryolite (in talc), applied about five times at intervals of 15–20 days, and by a mixed treatment consisting of three applications of a spray of 0·7 per cent. sodium fluosilicate with 0·5 per cent. DDT followed by about four treatments with dusts of

50 or 75 per cent. barium fluosilicate. Sprays alone, other concentrations of the dusts and other combinations of the two were less effective.

In a test to determine the increase in the quality and quantity of the crop after treatment, five varieties of irrigated American cotton were dusted eight times with 75 per cent. cryolite. The percentage attack was reduced from 95·1–98 to 10·5–18·9, the percentage of cotton stained was reduced from 58·3–84·8 to 12·2–16·8, and the total yield was 13–57 times as great as for no treatment.

The importance is stressed of applying the insecticides by the most effective means, and the relative merits of hand and power apparatus for dusting are discussed. Sprays appeared to be more economical than dusts for treatments applied before the development of the bolls, but only dusts gave adequate coverage of the bolls themselves. Sodium fluosilicate caused scorching in some fields in which humidity was high and is recommended for use only in dry areas. Organic insecticides should not be used when natural enemies, such as *Rogas* (*Rhogas*) *aligharensi* Qadri, which gives good control of *E. insulana* in the south of Spain [*cf.* **41** 49], are present. The possibilities of simultaneously controlling other cotton pests by a mixed programme of treatments with chlorinated and inorganic insecticides are discussed.

Gómez Clemente (F.), González Regueral (F.) & Planes García (S.). **Estudios sobre fumigación cianhídrica de naranjos realizados en la Estación de Fitopatología agrícola de Burjasot (Valencia).** [Studies on Fumigation of Oranges with Hydrogen Cyanide carried out at the Agricultural Phytopathology Station, Burjasot (Valencia).]—*Bol. Pat. veg. Ent. agríc.* **19** (1951–52) pp. 87–106, 7 figs., 4 graphs, 8 refs. Madrid [1954].

The authors give figures showing the extent to which fumigation with hydrogen cyanide is used against Coccids on *Citrus* in Spain and the expenses involved, describe the methods of application and give details of a technique for sampling the concentrations of gas at the base, middle and top of the trees in the tents during treatment. Comparison of concentrations showed that the pot method of generation was effective in both summer and winter, giving adequate concentrations in the middle section, where the heaviest infestations occur. The use of liquid HCN was equally satisfactory in summer, but Calcid calcium cyanide gave lower concentrations. Dosage tables are reproduced from a paper already noticed [*R.A.E.*, A **26** 702].

Gómez Clemente (F.) & Planes García (S.). **Experiencias de lucha contra la *Ceratitis capitata* en melocotoneros por medio de mosqueros y pulverizaciones con insecticidas orgánicos clorados.** [Experiments on the Control of *C. capitata* on Peaches with Bait-traps and Sprays of chlorinated organic Insecticides.]—*Bol. Pat. veg. Ent. agríc.* **19** (1951–52) pp. 107–134, 7 figs., 2 graphs. Madrid [1954].

Experiments on the control of *Ceratitis capitata* (Wied.) on peach near Valencia [*cf. R.A.E.*, A **40** 213] were continued in 1949–52. In 1949, when sprays were applied on 11th and 23rd July, the percentage of fruits punctured on a variety picked between 29th July and 8th August was reduced from 18·63 for no treatment to 2·72 and 5·11 by 0·5 and 0·25 per cent. Gesarol 50 (containing 50 per cent. DDT) and to 10·97 and 8·02 by 1 and 0·5 per cent. Gesarol 20 (20 per cent. DDT), respectively. Another DDT preparation used at equivalent rates proved much less satisfactory. Bait-traps containing 4 per cent. ammonium phosphate had been hung in unsprayed trees of a

medium-early variety from 2nd July for control, and at picking, which began on 20th July, 4·33 per cent. of the fruits were punctured.

In 1950, Gesarol 50 was the only insecticide used. When applied on 22nd and 29th July at 0·5 and 0·25 per cent. to varieties picked between 24th July and 12th August, it resulted in 2 and 3 per cent. punctured fruits, respectively, and when it was applied at 0·5 per cent. on the first date and 0·25 per cent. on the second, the percentage rose from 1 on 28th July to 10 on 20th August. On trees protected with the bait-traps only, 4 per cent. of the fruits were punctured.

In 1951, the first adults of *Ceratitis* were taken on an early variety on 21st June and sprays of 0·25 per cent. Gesarol 50 were applied on that date. The percentages of fruits punctured were 1·16, 10·8 and 15 at picking on 3rd, 6th and 9th July, respectively. On the medium-early variety, the first adult was taken on 4th July, 0·5 per cent. Gesarol 50 was applied on 6th and 14th July, and the percentage of fruits punctured rose from 2·6 at the beginning of picking on 16th July to 4·2 and 23 at the end of it on 29th July and 1st August, respectively, with an average of 2·9 for the 11 picking dates. After similar sprays of 0·25 per cent. Gesarol 50, the corresponding percentages were 2·3, 7·7 and 24, with an average of 4·2. It was estimated that 90 per cent. of the fruits were punctured in a neighbouring untreated orchard.

Bait-traps were extensively used on early varieties in 1952, and the numbers of flies taken are shown in detail. Treatment was begun early, and picking took place between 28th June and 11th July. The percentages of fruits punctured were 5·11 and 6·91 for 0·25 per cent. Gesarol 50 applied on 3rd, 13th and 23rd June and 25·59 for sprays of 0·2 or 0·3 per cent. Agronexa (8 per cent. lindane [almost pure γ BHC]) applied on 3rd, 13th and 28th June, as compared with 19·38 on trees protected with bait-traps only and 50 for no treatment. A variety maturing somewhat later was sprayed with 0·3 per cent. Agronexa on 4th and 15th July, and the percentage of fruits punctured ranged from 3·75 to 12·9 on nine picking dates between 11th and 22nd July, averaging 6·71. The corresponding percentages for similar sprays of 0·25 per cent. Gesarol 50 were 3·33–11·76, with an average of 5·6. On a similar variety, sprayed with 0·25 per cent. Gesarol 50 on 11th July and again, because of rain, on 15th July, the percentage rose from 3·22 on 24th July to 23·8 on 1st August, averaging 8·33 for four picking dates. On neighbouring untreated trees, 80–90 per cent. of the fruits were punctured.

Gómez Clemente (F.). **Un tisanóptero causante de daños en las naranjas de algunas zonas de Levante.** [A Thrips causing Injury to Oranges in certain Districts of eastern Spain.]—*Bol. Pat. veg. Ent. agric.* **19** (1951–52) pp. 135–146, 9 figs., 6 refs. Madrid [1954].

Heliothrips haemorrhoidalis (Bch.) was first observed causing appreciable injury to oranges in eastern Spain in 1948, when it was present in coastal groves between Gandía and Oliva, in the Province of Valencia. It had spread north of Gandía and south to the Province of Alicante by 1950, in which year the dry, hot summer and mild autumn, with a relative humidity of about 80 per cent., favoured its development. Large populations also occurred on shady hedges surrounding the groves. The thrips feeds on the leaves and fruits, but prefers the latter, causing characteristic lesions on the rind, usually on oranges that have changed colour, and often at the point of contact with leaves or other fruits. Fumigation with hydrogen cyanide against Coccids also controls the thrips, but does not prevent reinfestation. Mixed sprays of mineral oil with nicotine sulphate or pyrethrum are recommended, treatment to be applied when infestation is first observed on the fruits. If reinfestation occurs, sprays of nicotine sulphate or pyrethrum

alone should suffice. The hedges surrounding the groves should be sprayed with DDT, but this is not advised for the trees themselves as it is harmful to the natural enemies of Coccids.

Gómez Clemente (F.) & del Rivero (J. M.). **Ataques de ácaros consecutivos a tratamientos de manzanos con D.D.T. contra la** *Cydia pomonella* **L.** [Attack by Mites following Treatment of Apple Trees with DDT against *C. pomonella.*]—*Bol. Pat. veg. Ent. agric.* **19** (1951–52) pp. 147–159, 5 figs., 3 graphs, 7 refs. Madrid [1954].

In the experiments described, which were carried out near Valencia in 1951, apple trees were sprayed with 0·25 and 0·125 per cent. DDT on 18th May (a little after petal-fall) and on 2nd and 27th June, and with lead arsenate at 0·75 per cent. on the first date and 0·5 per cent. on the other two, against *Cydia pomonella* (L.). The treatments were timed by means of bait-trap catches of adults, the results of which are given. On 16th July, most of the trees treated with DDT were found to be heavily infested by *Bryobia praetiosa* Koch, which is briefly described, and all were subsequently sprayed with 0·5 per cent. lead arsenate, to avoid further increases of the mite. The effectiveness of the treatments was measured during the season by the numbers of fallen apples infested by *C. pomonella* and the numbers of larvae taken in trap-bands on the trees. Treatment with lead arsenate gave the best results, and the effectiveness of DDT increased with the concentration applied. In subsidiary tests, good control of the mite was given by sprays of 1 per cent. wettable sulphur and 0·2 per cent. Aramite containing 15 per cent. active ingredient [2-chloroethyl 2-(p-tert.-butyl-phenoxy)-1-methylethyl sulphite], but trees that had been heavily infested on 16th July and were then sprayed with lead arsenate were in general free from the mite by 6th August.

The mites were most abundant on trees treated with the higher concentration of DDT, and it is concluded that their natural enemies had been destroyed. Similar increases in mite population were reported from orchards dusted with a mixture of DDT and BHC. It is thought, however, that one application of DDT followed by combined sprays of DDT and an acaricide might prove satisfactory.

Gómez Clemente (F.) & del Rivero (J. M.). **Contribución al conocimiento de la biología y medios de lucha contra el barrenador del arroz,** *Chilo suppressalis* **Wlk. (***simplex* **Btlr.).** [A Contribution to Knowledge of the Biology and Control of the Rice Borer, *C. suppressalis.*]—*Bol. Pat. veg. Ent. agric.* **19** (1951–52) pp. 161–188, 7 figs., 11 refs. Madrid [1954].

Observations on *Chilo suppressalis* (Wlk.) on rice in Valencia [*cf. R.A.E.*, A **40** 210] were continued in 1949–51. In 1949, pupation of the overwintered larvae began on 4th April and the first adults emerged on 20th April, the average temperature during this period being 17°C. [62·6°F.]. Adults and evidence of infestation were observed in the seed-beds, and though these latter might prove a source of dissemination of the pest, it is pointed out that infestation usually originates in the rice-fields themselves. Since larvae seeking winter quarters readily shelter in dry stalks [*cf.* **26** 770], which may then be destroyed, several materials were tested for suitability. Larvae placed on 6-in. lengths of rice or wheat straw or *Arundo donax* all entered them, and in the case of *A. donax*, pieces with a maximum diameter

of about 0·2 in. were preferred. When larvae were placed on a mixture of all three materials, most entered *A. donax*.

Examination of the stubble and middle and upper parts of the rice stalks after harvesting showed that no larvae remained in the upper parts of the stalks, which included the ears and dried up quickly. Larvae were found in both the other parts, and many of those present in the stubble were found head downwards, indicating that they had migrated from the middle section in search of moisture. The rice should therefore be cut as low as possible in order to avoid providing shelters for the larvae. When the stacks of rice straw, which is kept for the manufacture of paper, were exposed to the sun and became dry, the larvae abandoned them, but when they were kept moist, the larvae remained inside the stalks.

In work on the control of the larvae, attention was given to insecticides that might be added to the irrigation water in the rice-fields. Larvae were introduced into jars half full of liquid, and any that floated or attached themselves to the sides or to pieces of straw placed on the surface were removed for confirmation of mortality. Complete kill was given in two hours by 0·5 per cent. of an emulsion concentrate containing 21 per cent. BHC and in 24 hours by 0·5 per cent. of a product containing 15 per cent. BHC and by 0·5 and 1 per cent. of another containing 5 per cent. DDT. When infested rice stubble was placed in soil in pots and covered with various liquids, a 0·05 per cent. emulsified solution of DDT killed all the larvae in two days, whether they remained in the stubble or came to the surface of the soil. BHC gave complete mortality only of the larvae that came to the surface. Flooding the fields after harvest has been stated to reduce infestation [*cf.* **29** 458], and observations in February 1951 showed that submerging the stubble for at least 15 days greatly reduced the numbers of larvae present.

In laboratory tests in which larvae were placed on rice stalks that had been dusted or sprayed with proprietary products (sprays being first allowed to dry), complete mortality was given by dusts of 1 and 2 per cent. parathion in 24 hours, by dusts of cryolite, 2·5 per cent. DDT or 7·5 per cent. BHC and by emulsion sprays of 0·006 and 0·012 per cent. parathion in 48 hours, and by a 15 per cent. BHC dust, and a dust containing 3 per cent. γ BHC, 5 per cent. DDT and 40 per cent. sulphur in 72 hours. Poor results were given by field treatments, though DDT showed some promise.

Planes García (S.). **La arañuela roja, nueva plaga de los naranjos en el Levante español.** [*Brevipalpus phoenicis*, a new Pest of Oranges in eastern Spain.]—*Bol. Pat. veg. Ent. agric.* **19** (1951–52) pp. 189–196, 5 figs. Madrid [1954].

The mite that causes pitting and splitting of the skin of orange and mandarin orange fruits in Valencia [*R.A.E.*, A **35** 149] was identified by E. W. Baker as *Brevipalpus phoenicis* (Geijskes). The author gives an account of observations on its bionomics and control similar to one already noticed [*loc. cit.*], and states that the females lay 6–10 eggs each.

Gómez Clemente (F.). **Insectos y ácaros parásitos de los *Citrus* en las comarcas españolas del mediterráneo.** [Insects and Mites that attack *Citrus* in the Mediterranean Regions of Spain.]—*Bol. Pat. veg. Ent. agric.* **19** (1951–52) pp. 197–220, 29 figs., 31 refs. Madrid [1954].

A systematic list is given from the literature of insects and mites that attack *Citrus* in Spain, with notes on the distribution, food-plants and control of the more important. Coccids [*cf. R.A.E.*, A **34** 269] are the most injurious.

Gómez Clemente (F.) & del Rivero (J. M.). **La rosquilla negra** (*Prodenia litura* **F.**).—*Bol. Pat. veg. Ent. agric.* **19** (1951–52) pp. 221–278, 12 figs., 43 refs. Madrid [1954].

The authors describe all stages of *Prodenia litura* (F.), which caused severe damage to various crops, including tomatos, in the Provinces of Alicante and Murcia in 1949, and review from the literature its synonymy, distribution, food-plants and bionomics, the damage that it causes, its natural enemies, and methods of control.

In laboratory tests in which larvae in various instars were placed on potato and lucerne plants sprayed with different products and allowed to dry, complete mortality was given in 48 hours by emulsion sprays of 0·05 per cent. DDT and 0·075 per cent. malathion and by 0·5 per cent. of a product containing 18 per cent. DDT with 2 per cent. lindane [almost pure γ BHC], other materials being less effective. Larvae placed on leaves and shoots of potato dusted with cryolite or 6 per cent. DDT all died in 72 hours. In tests of baits, complete mortality was given in 72 hours by mixtures of sodium fluosilicate and fine wheat bran (1:20), sodium arsenate and finely ground pods of carob (*Ceratonia siliqua*) (1:25), and 40 per cent. toxaphene and coarsely ground carob (1:50), all moistened with water. Of the other baits tested, sodium fluosilicate and coarsely or finely ground carob (1:20) and barium fluosilicate and coarse bran (1:20) gave 95 per cent. kill in 72 hours.

In field tests, excellent results were given on lucerne by sprays of 0·9–1·125 lb. technical DDT per acre and by a combined spray of DDT and lindane applied at 0·81 and 0·144 lb. per acre, respectively. DDT at 0·45 lb. per acre in an emulsified solution was somewhat less effective. A bait of cryolite and coarse bran (1:20) proved satisfactory when distributed at 54 lb. per acre. It is concluded that spraying or dusting with DDT at suitable rates every ten days should afford control. The importance of correct application of treatments is stressed, and practical information is given on the preparation of baits and on the use of the insecticides recommended. The relative toxicity to warm-blooded animals of some commonly-used insecticides is discussed from the literature.

Gómez Clemente (F.) & del Rivero (J. M.). **Notas experimentales sobre la mosca del olivo.** [Notes on Experiments against the Olive Fly.]—*Bol. Pat. veg. Ent. agric.* **19** (1951–52) pp. 279–287, 1 graph, 2 refs. Madrid [1954].

Experiments on the control of *Dacus oleae* (Gmel.) on olive were continued near Valencia in 1949–52 [*cf. R.A.E.*, A **41** 391]. Bait-traps were tested in all four years, the attractant being ammonium phosphate, and were moved weekly so as to avoid any effect of position. In 1949, the numbers of adults taken per trap over a period of 98 days in August–November averaged 2,327 when a 4 per cent. solution was renewed fortnightly and 2,043 when the solution was not renewed but the water was replenished fortnightly. In 1950, the corresponding averages were 2,523 and 2,109 over a period of 56 days in August–September. The same solution was used in 1951, over a period of 112 days in July–November, and the catches per trap averaged 264 when it was renewed every 14 days, 522 when it was renewed after 56 days and the water replenished fortnightly, and 758 when the water was replenished only. In 1952, over 112 days in July–November, the catches averaged 517 for 2 per cent. ammonium phosphate renewed every 14 days, 362 for the same solution renewed after 56 days with the water replenished every 14 days, and 622 and 480 for 2 and 4 per cent. ammonium phosphate, respectively, with the water replenished as before.

Sprays were tested in 1951, applications being made on 21st July, 18th August and 22nd September, and bait-traps were installed in the treated trees. The percentages of fruits punctured on 22nd September and 3rd November and (in brackets) the number of adults taken per trap were 12 and 92·4 (161) for 0·3 per cent. of a product containing 8 per cent. lindane [almost pure γ BHC], 32·2 and 95·6 (555·4) for 2 per cent. lime-sulphur (28° Bé.), and 3·4 and 47·8 (106·4) for bordeaux mixture (1 per cent. copper sulphate and 2 per cent. lime), as compared with 16·4 and 95 (500·2) for no treatment. In 1950, two applications of bordeaux mixture, on 1st and 29th August, gave good results until late September but by 30th November almost all the olives were punctured.

In September–November 1950, a comparison was made of the numbers of mature females taken in bait-traps containing 4 per cent. ammonium phosphate and collected on adhesive bands (without attractant) placed on the same trees, and of the numbers of eggs that they contained. The percentage of mature females was generally high and was greater in the bait-traps than on the bands up to the end of September, after which the population decreased, and the percentage was about the same for both methods of capture. There was no great difference between the numbers of eggs in females taken by the two methods.

Petty (B. K.) & Lochner (E. H. W.). **The Contact, Fumigation and Systemic Actions on Insects of certain new Phosphorus Compounds.** —*Sci. Bull. Dep. Agric. S. Afr.* no. 343, [2+] 22 pp., 12 figs., 10 refs. Pretoria, 1953.

The relative toxicity of proprietary products containing schradan, bis-(dimethylamino) fluorophosphine oxide [dimefox], bis(monoisopropylamino) fluorophosphine oxide [mipafox] and paraoxon, applied as contact and systemic insecticides and as fumigants, was investigated in the laboratory in South Africa to ascertain the methods of application most suitable to ensure control of plant pests while safeguarding beneficial insects. All materials were diluted to 0·4 per cent. active ingredient for use, and mortality was calculated by means of Abbott's formula [*R.A.E.*, A **13** 331]. In the tests on fumigant action, workers of the termite, *Trinervitermes havilandi* Fuller, were exposed for five hours on filter paper in petri dishes, of which the lids were fitted with two layers of filter paper, 9 cm. in diameter, that had been treated 30 minutes earlier with 0·8 ml. diluted insecticide. In those on contact action, soldiers of *T. havilandi* [*cf.* **40** 363] were exposed for 2½ hours on filter papers treated 30 minutes earlier with 0·5 ml. diluted insecticide in open petri dishes, and in both series of tests, the termites were transferred after exposure to clean petri dishes and supplied with means of nourishment. Knockdown was recorded for up to six hours, and mortality at intervals of 24 hours. The same treated filter papers were used with fresh batches of insects two weeks later and subsequently at monthly intervals to determine the persistence of toxicity. In the fumigation tests, paraoxon had by far the quickest action. It gave almost 100 and dimefox almost 90 per cent. mortality in 24 hours, whereas mortality from mipafox reached only 10 per cent. in 48 hours and schradan had no effect. Mortality due to paraoxon fell almost to 20 per cent. two weeks after application and to about 10 per cent. four weeks later, but that due to dimefox was 90 after two weeks, after which it fell steadily and reached 10 per cent. after a further eight weeks. Mipafox had virtually no persistent toxicity. Paraoxon was also the most rapid and effective material in the contact tests, in which it gave complete mortality in 24 hours; mipafox and dimefox gave about 90 per cent. mortality over the same period and complete or almost complete

mortality in 48 hours. All three materials killed almost all the termites exposed to them two weeks later, but whereas mortality from dimefox and mipafox after a further four and eight weeks, respectively, had fallen to 10 per cent., that due to paraoxon was about 50 per cent. 18 weeks after application and fell to 10 only after 42 weeks. Schradan had no contact toxicity.

The test insects used for the work on systemic action were apterae of an unidentified Aphid on *Lonicera japonica*. They were confined for 48 hours in small, transparent, perforated cages on the bottom leaf and the uppermost fully expanded leaf on twigs of *L. japonica*, each 1 ft. long and bearing ten leaves, that had been placed 30 minutes earlier in jars with their cut ends embedded in 70 gm. sifted soil to which were added 10 ml. water and 5 ml. diluted insecticide. Knockdown was recorded every six hours and mortality every 24 hours. Schradan and dimefox gave complete and mipafox almost complete mortality on both upper and lower leaves in 48 hours, and paraoxon gave 80 and about 65 per cent. mortality on the lower and upper leaves, respectively, in the same period. Schradan was rather more rapid in action than the others, and mipafox significantly slower at the beginning of the experiment. All the materials acted more rapidly against Aphids on the lower than on the upper leaf.

It is concluded that schradan can be applied either to the roots or to the foliage of plants without interfering with beneficial insects, since it has no contact or fumigant action, but that the other three materials should be applied only to the roots.

The results of similar tests in which the contact and fumigant effects of Systox [diethyl 2-(ethylmercapto)ethyl thiophosphate] were compared with those of paraoxon and its systemic action with that of schradan are given in an appendix. When applied as fumigants, both paraoxon and Systox gave complete mortality of the termite in 30 minutes, but whereas the percentage mortality due to the former after ten weeks was only 6·6, that due to Systox was 27·8. Both materials also gave complete kill in 30 minutes by contact, and they gave 41·2 and 76·6 per cent. mortality, respectively, ten weeks after application and 5·4 and 8·3 per cent. after a further 28 weeks. In tests of systemic action, in which Systox was used at 0·2 instead of 0·4 per cent., both it and schradan gave complete mortality of Aphids on the bottom leaf in 48 hours; mortality on the top leaf in the same period was 96·5 and 94·6 per cent., respectively. Systox acted rather more rapidly than schradan.

Dürr (H. J. R.). **The relative Attractiveness of Sucrose, Invert Sugar and Saccharine to the Argentine Ant.**—*Sci. Bull. Dep. Agric. S. Afr.* no. 345, 27 pp., 4 graphs, 30 refs. Pretoria, 1953.

The following is almost entirely the author's summary of this account of investigations carried out in South Africa in 1951–52 with the object of improving the effectiveness of poison baits for the control of *Iridomyrmex humilis* (Mayr). The literature containing recommendations for the incorporation of sugar or sugar products in poison baits for the control of *I. humilis* is briefly reviewed. In the past, the recommended concentrations of sugar varied from about 17 to 65 per cent. in other countries and from 33 to 64 per cent. in South Africa. The attractiveness of sugar solutions was measured by exposing dishes containing them to worker ants and calculating the volume consumed during a given period, corrections being made for loss by evaporation and weight of dead ants that had fallen into the solution, and the results of at least six replications per test were statistically analysed for significance. In one experiment, this process was compared with that

of periodically counting the number of feeding ants, and similar results were obtained in both cases, indicating the validity of the method adopted.

The following are the results obtained and conclusions reached. At a concentration of 47·5 per cent., sucrose, diluted golden syrup (containing 62 per cent. inverted sucrose) and a solution of equal parts of glucose and fructose (which is chemically identical with invert sugar) did not differ significantly in their attractiveness to the ant. It is thus immaterial which is used, but invert sugar is preferred in practice because of its resistance to crystallisation. The upper threshold of attractiveness of partly inverted sugar (golden syrup) was between 64 and 70 per cent., and the lower threshold was below 5, but probably higher than 2 per cent. The optimum concentration for use in the autumn, when baits are usually set out, ranged from at least 25 to 45 per cent. or higher, and concentrations of 47, 51 and 64 per cent., which are the three recommended in South Africa [*cf. R.A.E.*, A **30** 88], did not differ significantly in attractiveness. The higher concentrations are preferable because of the slower rate of evaporation. Saccharine at a concentration of 5 per cent. was not attractive to the ant and rendered a solution of 50 per cent. sugar unattractive when added to it.

Faure (J. C.). **Field Experiments with Insecticides against Cotton Bollworms 1951–52.**—*Ent. Mem. Dep. Agric. S. Afr.* **2** pt. 12 pp. [3+] 503–522, 4 figs., 9 refs. Pretoria, 1953.

The following is largely based on the author's summary of this account of experiments on the control of cotton bollworms at Barberton, South Africa, in 1951–52. They were carried out on plots of about 1/62 acre, which is considered to be an adequate size, since significant differences were obtained. The species present were *Diparopsis castanea* Hmps., *Heliothis armigera* (Hb.) and *Earias insulana* (Boisd.). Weekly counts of eggs showed no peaks of abundance. Infestation was light, and larvae were present in only 12 per cent. of the damaged buds, flowers and bolls. Eggs of *D. castanea* were the most numerous, but larvae of *H. armigera* probably caused most of the damage, and the control obtained was probably due mainly to the effect of the insecticides on this species.

A dust of 10 per cent. DDT with 1 per cent. γ BHC applied 2–6 times during February–March at 20 lb. per acre resulted in significant increases in the yield of seed cotton; six applications at weekly intervals caused a significantly greater increase than two made 12 days apart. Six weekly applications of an emulsion spray containing DDT and γ BHC at concentrations and rates giving amounts of actual toxicant per acre equivalent to those given by the dust were not significantly superior to two of the dust, but the results were inconclusive owing to the coarseness of the nozzle employed. The boll-setting season was short as a result of drought, and little information was obtained on the relative value of different numbers of applications.

In a comparative test of insecticides applied four times during February–March, significantly increased yields were given by the combined dust of DDT and BHC at 15 lb. per acre, equivalent amounts of DDT and BHC in the spray at 10–15 gals. per acre, and dusts of 5 per cent. DDT with 3 per cent. γ BHC and of 20 per cent. toxaphene at 15 lb. per acre, but not by dusts of 10 and 5 per cent. DDT at 15 and 30 lb. per acre, respectively. The spray was superior to the equivalent dust, and the two combined dusts were equal in effectiveness. The yield from plots dusted with toxaphene exceeded those from plots treated with combined dusts, but the difference was not quite significant. An air-compressor driven by a small petrol engine was used for both dusting and spraying and proved very satisfactory; it permitted the application of approximately exact dosages of dusts and

sprays on the plots, despite their small area, and the paint-gun sprayer combined with it produced a very fine fog suitable for dosages as low as 5 gals. per acre.

Lepage (H. S.), Giannotti (O.) & Orlando (A.). **Experiências de campo, com diversos inseticidas, no contrôle de algumas pragas do algodoeiro.** [Field Experiments with various Insecticides for the Control of Cotton Pests.]—*Biológico* **20** no. 11 pp. 183–195, 1 fig., 4 graphs, 9 refs. São Paulo, 1954.

Experiments on the control of pests of cotton in São Paulo [*cf. R.A.E.*, A **41** 423] were continued in 1952–53, when only *Aphis gossypii* Glov. was numerous enough for counts to be reliable. The sprays were prepared from emulsion concentrates and applied at low rates on 19th December to cotton sown a month earlier. The percentage reduction in the numbers of Aphids per leaf five and (in brackets) 13 days after spraying, as compared with the numbers present before treatment, were 98·8 (95·9) for 1 per cent. Systox (50 per cent. diethyl 2-(ethylmercapto)ethyl thiophosphate), 95·2 (93·5), 95·1 (93·5) and 97·8 (94) for 1·5, 3 and 6 per cent., respectively, of a preparation containing 19·5 per cent. endrin, 96·6 (89) for 0·3 per cent. of a product containing 46·6 per cent. parathion, 94·8 (91·8) for 2 per cent. of one containing 14 per cent. lindane (98·7 per cent. γ BHC), and 94·7 (88·8) for 6 per cent. of a product containing 50 per cent. toxaphene. The corresponding figures for a dust of 3 per cent. γ BHC, 5 per cent. DDT and 40 per cent. sulphur applied on the same date were 84·1 (85·1), and those for no treatment 15 (50).

Heavy rain fell at the beginning of January, and further counts made on 20th January to investigate the residual effects of the insecticides showed that the numbers of Aphids per leaf averaged nearly 165 for no treatment, 20 for Systox, 81, 52, and 33 for endrin at the three concentrations, respectively, 97 for toxaphene, and over 100 for the other products. The treatments were applied a second time on 21st January, and inspection of the plots 14 days later showed that those sprayed with Systox, the highest concentration of endrin, and toxaphene had the best appearance. Counts of the Aphid were not made as populations were small on all plots. By 28th March, the plants treated with these three materials were taller than the others and their growth was more vigorous. Treatments were applied a third time on 31st March, the only change being the substitution of a spray of 2·2 per cent. of a product containing 23 per cent. aldrin for parathion. The crop was picked on 9th June, and the percentage increases in yield of cotton, as compared with no treatment, were about 45, 52·3 and 105·1 for endrin at the three concentrations, respectively, 46 for Systox, 44·2 for toxaphene, 38·5 for lindane, 34·9 for the dust, and 33 for parathion followed by aldrin.

Leiderman (L.). **Combate ao trips da cebola com inseticidas orgânicos.** [Control of the Onion Thrips with organic Insecticides.]—*Biológico* **20** no. 11 pp. 196–201, 8 refs. São Paulo, 1954.

In view of the increased cultivation of onions in the State of São Paulo in recent years, field experiments were carried out in 1954 on the control of a thrips, probably *Thrips tabaci* Lind., that is injurious there. The distribution, food-plants and bionomics of *T. tabaci* and the damage caused by it are briefly reviewed from the literature. Sprays (all from wettable powders with an adhesive) and dusts were applied to infested plants three times at fortnightly intervals in July and August. In the sprayed series, the

percentage reductions in the numbers of plants infested with 5–9 nymphs or adults and (in brackets) 10 or more, as compared with no treatment, were 100 (100) for 0·06 per cent. dieldrin, 99 (100) for 0·03 per cent. parathion, 93·3 (100) for 0·18 per cent. toxaphene, 93·3 (97·4) for 0·18 per cent. chlordane, 91·4 (96·1) for 0·06 per cent. aldrin, 90·5 (100) for 0·03 per cent. lindane [almost pure γ BHC], 86·7 (97·4) for 0·18 per cent. DDT and 70·5 (89·6) for 0·18 per cent. methoxy-DDT (methoxychlor) a week after the last application. A fortnight after it, the corresponding figures were 98 (98·6) for dieldrin, 72·4 (86·1) for parathion, 67·3 (84·7) for toxaphene, 80·6 (93) for chlordane, 69·4 (79·2) for aldrin, 66·3 (84·7) for lindane, 66·3 (80·5) for DDT and 42·9 (61·1) for methoxy-DDT. In the series treated with dusts, they were 97·6 (100) for 2 per cent. dieldrin, 1 per cent. parathion or 10 per cent. toxaphene, 97·6 (96·1) for 10 per cent. chlordane or 2 per cent. aldrin, 95·2 (100) for 10 per cent. DDT or methoxy-DDT and 90·5 (96·1) for 1 per cent. lindane a week after the last application, and 66·7 (76·5) for dieldrin, 83·3 (98) for parathion, 62·2 (78·4) for toxaphene, 86·7 (94·1) for chlordane, 63·3 (78·4) for aldrin, 76·7 (86·3) for DDT, 65·5 (70·6) for methoxy-DDT and 46·7 (52·9) for lindane a fortnight after it. As the sprays of dieldrin, chlordane and parathion and the dusts of chlordane, parathion and DDT gave the best results, treatment with any of these is recommended; it should begin at the first sign of infestation and be repeated every 7–10 days.

Popov (G.). **Investigations of suspected Outbreak Areas of the Desert Locust** (*Schistocerca gregaria* **Forskål**) **in Iran.**—*Anti-Locust Bull.* no. 14, [2+] 30 pp., 8 pls., 3 maps (2 fldg.), 24 refs. London, 1953.

The following is substantially the author's summary. Some of the suspected breeding and outbreak areas of *Schistocerca gregaria* (Forsk.) in Persia were surveyed during the spring of 1950, the following winter and the spring of 1951, and their topography, vegetation and climate are described. The information available on locust activity during the quiescent periods preceding the outbreak of 1940–47 and the one then in progress, indicated that the latter, which followed the development of two generations during the monsoon breeding period of 1949 in the deserts of north-western India and Pakistan [*cf. R.A.E.*, A **40** 25], was connected with the previous building up and partial transformation to the gregarious phase of populations in the winter-spring breeding areas of Persia and Pakistan. The ecological similarity of some breeding areas in Persia to better known ones in India, Pakistan and Oman and an analysis of recent developments in the locust situation indicate that Persia is not merely subject to invasions from outbreak areas outside its territory [*cf.* **42** 415], but should be regarded as part of a complex of breeding and outbreak areas extending over India, Pakistan, Persia and eastern Arabia [*cf.* **42** 363]. Swarms were recorded in the Jaz Murian depression in southern Persia every spring from 1947 to 1949, at a time when they were rare and irregular in India, Pakistan, elsewhere in Persia, and eastern Arabia. It therefore seems desirable to keep this area under observation, especially between outbreaks.

Richards (O. W.). **The Study of the Numbers of the Red Locust** *Nomadacris septemfasciata* (**Serville**).—*Anti-Locust Bull.* no. 15, [2+] 28 pp., 4 figs., 8 refs. London, 1953.

The following is virtually the author's summary. Methods of estimating the numbers of adults of *Nomadacris septemfasciata* (Serv.) were studied in

the Rukwa Valley of south-western Tanganyika in July–September 1952. The two principal methods available are scouting (counting the number of locusts flushed per hundred paces), and marking, releasing and recapturing locusts. Some of the factors influencing counts by scouts were examined, such as the personal factor, including the length of pace, the time of day, and the height of the grass. A provisional formula relating the width of the band from which all locusts are flushed to the height of the grass was devised. This enables scouting records to be converted into estimates of locusts per square yard. Seven marking experiments were carried out, six of them in conjunction with estimates by scouting. A useful agreement was found between the two methods at lower densities, but in high concentrations of locusts, the scouting method breaks down. A provisional suggestion is made for the calibration of the grades of abundance used in a rough classification of density for mapping purposes. An examination of some of the scouting data recorded at Kafukola, in the first half of 1952 indicated a steady decline in the population after the production of adults from hoppers had ceased. In June, the area was invaded by a large concentration of adults that maintained a separate existence for a month within the area occupied by the dispersed population. Such concentrations probably have a semi-permanent existence since their formation from dispersed populations would denude an enormous area of dispersed locusts and should, therefore, be easily detected if formed in this way. Studies of this type would yield much more information if the intensive scouting system could be extended to a large area, such as the whole Central Rukwa.

Box (H. E.). **New Crambine Genera allied to *Diatraea* Guilding (Lepidoptera: Pyralidae). I.**—*Proc. R. ent. Soc. Lond.* (B) **22** pt. 9–10 pp. 178–180. London, 1953.

Eodiatraea, gen. n., is erected for *E.* (*Chilo*) *centrella* (Möschler) (the type), of which *Diatraea cancella* Hmps. is a synonym, *E.* (*D.*) *amnemonella* (Dyar), *E.* (*D.*) *amazonica* (Box), and *E.* (*D.*) *rufescens* (Box). All four species attack graminaceous plants. *E. centrella* is a well-known pest of sugar-cane and is recorded from Martinique, St. Lucia, St. Vincent, Grenada, Tobago, Trinidad, Venezuela, British Guiana, Dutch Guiana and French Guiana, *E. amazonica* feeds on *Paspalum fasciculatum* in Brazil [*R.A.E.*, A **23** 744], and *E. rufescens* attacks sugar-cane in Bolivia [**43** 115].

Dresner (E.). **Observations on the Biology and Habits of Pupal Parasites of the Oriental Fruit Fly.**—*Proc. Hawaii. ent. Soc.* **15** no. 2 pp. 299–310, 3 figs., 1 ref. Honolulu, 1954.

Fruit-fly puparia sent to Hawaii in connection with the introduction of parasites for trial against *Dacus dorsalis* Hend. [*cf. R.A.E.*, A **40** 236, etc.] gave rise in some cases to species of *Spalangia*, *Dirhinus*, *Psilus*, *Pachycrepoideus* and *Trichopria*, and investigations on the bionomics of these parasites were made in the laboratory to develop suitable methods of propagation and to ascertain the extent to which they might act as hyperparasites.

Species of *Spalangia* were received from many tropical countries. The only one identified was *S. philippinensis* Fullaway, which was obtained from New Caledonia, southern India and the Philippines and had already become established on Oahu after earlier releases against *Ceratitis capitata* (Wied.). Exposure of puparia of *D. dorsalis* parasitised by *Opius vandenboschi* Fullaway [= *O.* (*Biosteres*) *javanus* (Fullaway) (*cf.* **8** 435) nec Szépligeti]

and of unparasitised puparia of *D. dorsalis* failed to elicit any tendency to hyperparasitism in *Spalangia* spp., and there was a greater mortality of *Dacus* than of *Opius* at all levels of parasitism below 80 per cent. The *Spalangia* females oviposited in the anal ends of the host puparia, and more than one egg was often laid in a single host. All the species tested developed as external parasites on the host pupae within the puparia. The egg stage lasted 72–96 hours, and the larval and pupal stages averaged about ten and seven days, respectively. The adults emerged through circular holes near the ends of the puparia, and pairing and oviposition occurred soon after. Complete development lasted 20–40 days according to season, but a species from China entered diapause in November. All developmental stages within the puparia were attacked, from the newly formed pupae to adults almost ready to emerge. Development was equally favourable in puparia of *D. dorsalis*, *C. capitata*, *Musca domestica* L. and *Drosophila*, but puparia of *Carpomyia vesuviana* Costa were apparently not attacked.

Dirhinus giffardii Silv. from Africa and Australia is now established on Oahu and is occasionally recovered from fruit-fly material in the field. It caused about equal mortality of *Dacus dorsalis* and of *O. vandenboschi* in the host puparia. Oviposition occurred in the centro-ventral portion of the puparium. The larvae hatched in 36–48 hours, fed externally on the host and pupated 10–11 days after oviposition, the adults emerging 19 days after oviposition, and the life-cycle lasted longest in winter. Even with insufficient host material, single females produced 49–53 progeny each, with a range of 1·8–6·1 females per male. No development occurred in puparia of *D. dorsalis* more than nine days old.

Psilus sp. from Mindanao (Philippines) likewise caused no greater mortality of *D. dorsalis* than of *O. vandenboschi*. Oviposition occurred through the sides of the puparia, the eggs being placed within the host. The larvae hatched in four days and pupated nine days later, the larvae and pupae developing within the host pupae, and the adults emerged about 23 days after oviposition. Development occurred in puparia of all ages up to nine days old, and its duration ranged from 23 days in summer to 60 in winter.

The other parasites investigated were *Pachycrepoideus dubius* Ashm., which was obtained from nearly all the countries visited, and *Trichopria* sp. from India. The former parasitised both *D. dorsalis* and *Drosophila*, but the latter could not be reared on fruit-fly puparia though it developed readily on *Drosophila*.

Nirula (K. K.), Antony (J.) & Menon (K. P. V.). **A new Pest of Coconut Palm in India.**—*Indian Cocon. J.* **5** no. 3 pp. 137–140, 5 refs. Ernakulam, 1952.

Larvae of a Melolonthid identified by the Commonwealth Institute of Entomology as *Leucopholis coneophora* Burm., the larva, pupa and adult of which are described, were found damaging the roots of coconut palms in Travancore-Cochin in recent years. The young larvae feed on the fine roots and root hairs, but are of considerably less importance than the older ones, which attack the well established roots and often sever them near the trunks. Damage is most severe after early rains in April–June, when the larvae migrate towards the surface of the soil. As a result of the attack, the leaves turn yellow, the yield is greatly reduced, and, if it is severe, the nuts fall while immature; the growth of young palms is stunted and flowering retarded. Larvae are commonest in sandy and sandy loam soils. During hot, dry weather and the heat of the day, they usually remain deep in the soil, but congregate within 3–6 ins. of the surface when the upper soil layers are

moist and during the night and early morning. Heavy continuous rain is unfavourable and may cause high mortality, especially where the water level in the soil is high during the monsoon. The adults usually emerge from the soil at the onset of the rains at the end of May or beginning of June, but a few appear after early rain in March–April. The larvae also attack cassava [*Manihot utilissima*], sweet potato, yams [*Dioscorea*] and *Colocasia*, interplanted in coconut gardens, and losses of these crops have been so severe that their cultivation is being abandoned.

ANTONGIOVANNI (E.). **Prove di lotta contro la carpocapsa del melo con arseniato e con parathion.** [Experiments on the Control of *Cydia pomonella* with Arsenate and Parathion.]—*Riv. Fruttic.* **15** no. 3 pp. 183–196, 1 graph, 1 ref. Ravenna, 1953. (With Summaries in French and English.)

In view of the alleged development of resistance to lead arsenate by *Cydia* (*Carpocapsa*) *pomonella* (L.) in Italy [*cf. R.A.E.*, A **43** 22], experiments were carried out near Ferrara in 1951–52 in which sprays of 0·5 per cent. lead arsenate and 0·02 per cent. parathion were compared for its control on apple. The parathion spray was prepared from an emulsion concentrate. No evidence of resistance was found in either year. Treatments were applied six times between 20th May and 22nd August, at intervals of about a fortnight for the first three, and three weeks for the remainder. In 1951, lead arsenate and parathion reduced the percentage of fruits infested from 70·1 to 1·7 and 3·1, and the percentages of fruits with only superficial injuries were 19·5 and 22·1, respectively.

In 1952, combined schedules of parathion and lead arsenate sprays were tested in addition, and all trees received a fungicidal treatment with 0·35 per cent. wettable sulphur and 0·15 per cent. copper oxychloride on the first three dates. Adults of *C. pomonella* were first observed in emergence boxes about 1st May, and reached maximum numbers on 9th and 31st May, showing that the first application was made at about the correct time. Fallen fruits were collected and examined weekly from 24th June, and the crop was harvested on 7th October. The percentages of fallen and picked fruits that were infested were 70·27 for no treatment, 3·73 for two applications of parathion followed by one of parathion and lead arsenate together and three of lead arsenate, 3·87 for six treatments with parathion, 7·03 for six with lead arsenate, and 3·27 for two applications of lead arsenate followed by one of lead arsenate and parathion and three of parathion, with no significant difference between treatments. Fewer infested fruits were found beneath trees sprayed with parathion than beneath those treated with lead arsenate up to early August, but the position was reversed by mid-Sepember, probably because parathion did not retain its effectiveness over the longer intervals between the later applications. The percentages of the total yield that showed only superficial injuries were 43 and 35·7 for parathion and lead arsenate alone, respectively, indicating no great difference in this regard between the products, though parathion was expected to be inferior because of its reported penetration into the fruit [*cf.* **39** 250].

The parathion residues recorded from the unwashed fruits at picking in no case exceeded 0·5 part per million. It is concluded that satisfactory control would be given by a schedule comprising three sprays of parathion followed by three of parathion and lead arsenate or by one of parathion and lead arsenate and two of lead arsenate alone, at the intervals used in the test, or by seven of parathion alone at intervals of 15–17 days.

MURPHY

INSECTICIDES · FUNGICIDES · FUMIGANTS

The wide range of Murphy Products includes:

SYSTEMICS

SYTAM (Systemic Insecticide based on schradan)
TERRA SYTAM (Previously known as BFPO)

OVICIDES

MURVESCO (50% PCPBS) (para-chlorphenyl benzene sulphonate)
OVOCLOR (50% CPCBS) British Patent 669076 (para-chlorphenyl-para-chlorbenzene-sulphonate)

FUNGICIDES

MURFIXTAN (liquid mercury fungicide)
COMPOUND 618 (suspension mercury fungicide)

INSECTICIDES

DeDeTane (DDT) : ***LINDEX*** (lindane)

RODENTICIDE

MURPHERIN (warfarin)

MOLLUSCOCIDE

"SLUGIT" **LIQUID *SLUG KILLER***
The most revolutionary advance in slug control.

Full details and prices of all products available on request.

THE MURPHY CHEMICAL COMPANY LIMITED

WHEATHAMPSTEAD, ST. ALBANS, HERTFORDSHIRE

Telephone: Wheathampstead 2233. Cables: Alvesco, Wheathampstead, St. Albans, England.

INDEX OF AUTHORS

ANON., 262.
Amen, C. R., 277.
Anderson, C. W., 273.
Antongiovanni, E., 296.
Antony, J., 295.

Bagnall, R. H., 262.
Bart, G. J., 270.
Berim, N. G., 258.
Bird, F. T., 263.
Black, L. M., 266, 269, 278.
Blais, J. R., 264.
Bogavac, M., 261.
Boosalis, M.G., 274.
Box, H. E., 294.
Brakke, M. K., 269.
Brierley, P., 269.

Chernetsova, V. I., 257.
Collingwood, C. A., 281.

Davidson, R. W., 276.
del Rivero, J. M., 283, 286, 288.
Delucchi, V., 261.
Descamps, M., 259.
Dickson, R. C., 276.
Doolittle, S. P., 269.
Dresner, E., 294.
Dunning, R. A., 279.
Dürr, H. J. R., 290.

Faure, J. C., 291.
Frazier, N. W., 272.
Freitag, J. H., 272.

Gar, K. A., 257.
Giannotti, O., 292.
Giddings, N. J., 273.
Gómez Clemente, F., 282, 283, 284, 285, 286, 287, 288.
González Regueral, F., 284.
Griswold, C. L., 270.

Hagedorn, D. J., 278.
Hickin, N. E., 259.
Hollings, M., 280.
Horricks, J. S., 277.
Houston, B. R., 268.
Humphries, K. P., 279.

Jensen, D. D., 271, 276.
Johnson, C. G., 279.
Johnson, M. McD., 276.
Jones, F. G. W., 279.
Jones, L. S., 274.

Kassanis, B., 280.

Laird, E. F., 276.
Larson, R. H., 275.
Leiderman, L., 292.
Lepage, H. S., 292.
Lochner, E. H. W., 289.

MacCarthy, H. R., 273.
Mandel'baum, Ya. A., 257.
Maramorosch, K., 269, 272.
Mel'nikov, N. N., 257.
Menon, K. P. V., 295.

Nielson, M. W., 274.
Nirula, K. K., 295.

Orlando, A., 292.
Oswald, J. W., 268.

Patterson, N. A., 265.
Petty, B. K., 289.
Pickett, A. D., 265.
Planes García, S., 282, 283, 284, 287.
Popov, G., 293.

Raymer, W. B., 277.
Rich, S., 275.
Richards, O. W., 293.

Shaw, M. W., 279.
Shvetsova-Shilovskaya, K. D., 257.
Simons, J. N., 266, 274.
Skotland, C. B., 270, 278.
Slykhuis, J. T., 270, 271, 277.
Smith, F. F., 269
Stoner, W. N., 271.
Stride, G. O., 260.
Sylvester, E. S., 266, 267, 274, 278.

Tadić, M., 261.
Targe, A., 260.
Taylor, C. E., 281.
Taylor, L. R., 279.
Teitelbaum, S. S., 278.
Thomas, H. E., 276.
Trouillon, L. L., 260.

Webb, R. E., 275.
Whalen, M. M., 263.

Živanović, V., 262.

NOTICES

Secretaries of Societies and Editors of Journals willing to exchange their publications with those of the Institute are requested to communicate with the Director. Authors of papers on economic entomology, whether published in entomological journals or not, are invited to send reprints to the Director for notice in the *Review*.

The Executive Council of the Commonwealth Agricultural Bureaux is a signatory to the Fair Copying Declaration, details of which can be obtained from the Royal Society, Burlington House, London, W.1.

The Annual Subscription, *in advance*, to a volume of the *Review* Series A (Agricultural) is 40s. post free; Series B (Medical and Veterinary), 20s. post free. Prices of Back Volumes on application.

Orders and Subscriptions should be sent to the Director, Commonwealth Institute of Entomology, 56, Queen's Gate, London, S.W.7, or through a bookseller.

CONTENTS

PAGE

AFRICA, EAST: The Study of the Numbers of *Nomadacris septemfasciata* ... 293
AFRICA, FRENCH EQUATORIAL: Investigations on *Locusta migratoria* near Lake Chad 259
AFRICA, SOUTH: Laboratory Tests of Systemic Insecticides 289
AFRICA, SOUTH: The Attractiveness of Sugars to *Iridomyrmex humilis* ... 290
AFRICA, SOUTH: Tests on the Control of Cotton Bollworms 291
BRAZIL: Treatments against *Aphis gossypii* on Cotton 292
BRAZIL: Insecticide Tests against *Thrips tabaci* on Onions 292
BRITAIN: Wood-boring Beetles and their Control (*Review*) 259
BRITAIN: Observations on Potato Aphids 279, 281
BRITAIN: The Effect of Pests attacking Sugar-beet Seedlings 279
BRITAIN: Tomato Aspermy Virus in Chrysanthemum and its Aphid Vectors 280
BRITAIN: Two Aphid-borne Viruses of Carnation 280
BRITAIN: *Tetranychus telarius* on Black Currant and its Control 281
CANADA: Aphids and the Spread of Potato Virus Y 262
CANADA: Investigations on a Virus Disease of *Neodiprion sertifer* 263
CANADA: Fecundity and Flight of *Choristoneura fumiferana* 264

[Continued overleaf

CONTENTS—*cont.*

PAGE

CANADA: Spray Programmes and the Fauna of Apple Orchards 265
CANADA: *Aceria tulipae* and the Wheat Streak Mosaic Virus 277
FRANCE: Winter Treatment against Pests of Lucerne 260
FRANCE: The increasing Importance of Tetranychids 260
HAWAII: Observations on introduced Pupal Parasites of *Dacus dorsalis* ... 294
HOLLAND: A Jassid transmitting a Virus to Clover 272
INDIA: *Leucopholis coneophora* damaging Coconut Palms 295
ITALY: Rearing and Bionomics of Parasites of *Plutella maculipennis* ... 261
ITALY: Tests of Sprays against *Cydia pomonella* 296
PERSIA: Surveys of suspected Outbreak Areas of *Schistocerca gregaria* ... 293
SPAIN: The Biological Control of *Citrus* Pests 282
SPAIN: Weather and Infestation of Oranges by *Ceratitis capitata* 282
SPAIN: Tests of Insecticides against *Earias insulana* on Cotton 283
SPAIN: Fumigation of *Citrus* with HCN against Coccids 284
SPAIN: Sprays against *Ceratitis capitata* on Peach 284
SPAIN: *Heliothrips haemorrhoidalis* on Orange and its Control 285
SPAIN: DDT Sprays favouring *Bryobia praetiosa* on Apple 286
SPAIN: The Bionomics and Control of *Chilo suppressalis* on Rice 286
SPAIN: The Insects and Mites infesting *Citrus* 287
SPAIN: Tests of Insecticides against *Prodenia litura* 288
SPAIN: Experiments on the Control of *Dacus oleae* 288
U.S.A.: Jassids transmitting Plant Viruses to their Progeny 266
U.S.A.: Acquisition of Western Celery Mosaic Virus by four Aphids ... 266
U.S.A.: The *Brassica nigra* Virus and its Transmission by Aphids ... 266, 267
U.S.A.: Yellow Dwarf of Cereals and its Aphid Vectors 268
U.S.A.: Properties of the Wound-tumour Virus 269
U.S.A.: Aphids transmitting the Virus of Tomato Aspermy 269
U.S.A.: *Endoconidiophora fagacearum* in Excreta of *Drosophila* 270
U.S.A.: *Macrosiphum pisum* transmitting Wisconsin Pea Streak 270
U.S.A.: *Aceria tulipae* and Streak Mosaic of Wheat 270
U.S.A.: A New Wheat Virus transmitted by a Jassid 271
U.S.A.: Transmission of Peach and Cherry Viruses by *Colladonus geminatus* 271, 274, 276
U.S.A.: Pierce's Disease of Vines in Florida 271
U.S.A.: Jassids infected with Pierce's Disease of Vines in California ... 272
U.S.A.: Two new Strains of Curly Top Virus 273
U.S.A.: The Transmission of Potato Leaf-roll by Aphids 273
U.S.A.: A new Aphid-borne Virus of Cucurbits 273
U.S.A.: *Myzus persicae* transmitting Yellow Net of Tomato 274
U.S.A.: Crown Rot of Wheat associated with *Mayetiola destructor* 274
U.S.A.: Host Range and Vectors of Pea Enation Mosaic 274, 278
U.S.A.: The Identity of a Virus of Sweet Potato 275
U.S.A.: Organic Fungicides controlling Mites on Plants 275
U.S.A.: A Virus Disease of Cotton transmitted by Aleurodids 276
U.S.A.: Wood-staining Fungi associated with *Dendroctonus engelmanni* ... 276
U.S.A.: Aphids feeding on the Buds of *Cymbidium* 276
U.S.A.: *Macrosteles fascifrons* and a Virus Disease of Potato 277
U.S.A.: The Transmission of Lettuce Mosaic by *Myzus persicae* 278
U.S.A.: A Species of *Tetrastichus* attacking Sweet Clover 278
YUGOSLAVIA: The Bionomics and Control of *Hoplocampa* spp. on Plum ... 262
Radioactive Tracer Studies on the Action of two Thiophosphates 257
Synergism of Fluorine Compounds with DDT 258
The Nutrition of *Carpophilus hemipterus* 260
Maps of the Distribution of Insect Pests 262
Large Suction Traps for airborne Insects 279
A new Genus allied to *Diatraea* 294

Printed in Great Britain under the authority of HER MAJESTY'S STATIONERY OFFICE
by The Eastern Press, Ltd., London and Reading.

(1908) Wt. P8522/3895 9/55 E.P. Ltd. Gp. 566. [A]